DOE/RL-94-07
Revision 0

Ordnance and Explosive Waste Records Search Report

January 1995

United States
Department of Energy
P.O. Box 550
Richland, Washington

Approved for Public Release

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DEPARTMENT OF THE ARMY
HUNTSVILLE DIVISION, CORPS OF ENGINEERS
P.O. BOX 1600
HUNTSVILLE, ALABAMA 35807-4301

REPLY TO
ATTENTION OF

CEHND-PM-OT (210-20b) 24 February 1995

MEMORANDUM FOR Commander, U.S. Army Corps of Engineers, Hanford Program Office, ATTN: MSIN-A5-20 (Mr. Perro), P.O. Box 550, Richland, WA 99352-0050

SUBJECT: Final Report, Ordnance and Explosive Waste (OEW) Records Search for the Hanford Site

1. The Huntsville Division has reviewed the subject document, prepared by Dames and Moore, and subsequently published by the Department of Energy. The OEW Design Center sees no need for further action based on the results of the records search and site inspections.

2. If you have any questions, please contact the Project Manager, Mr. Charles "Hud" Heaton at commercial 205-895-1544.

FOR THE DIRECTOR OF PROGRAMS
AND PROJECT MANAGEMENT:

LAWSON S. LEE, P.E.
Chief, Ordnance and Technical Programs

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HUNTSVILLE U.S. ARMY CORPS OF ENGINEERS

EXECUTIVE SUMMARY

The Hanford Site is located within a remote, rural area of the state of Washington. Since 1943, the area has been government-controlled land with little or no public access. The U.S. Department of Energy (DOE) agreed to remediate the area under the Hanford Federal Facility Agreement and Consent Order. Part of the site restoration includes addressing concerns of ordnance and explosive waste (OEW). The initial phase of the assessment of OEW was the completion of an archive search to assess the potential for OEW at Hanford. Presented below are the findings and conclusions of the OEW archive search.

FINDINGS

The Army, 5th Antiaircraft Artillery (AAA) Group, operated 120mm AAA guns at the Hanford Site during the period March 1950 to December 1957.

Nineteen AAA batteries were located at the Hanford Site. Sixteen of the batteries had AAA installations. Each of these batteries included four 120mm guns (for a total of 64 guns at Hanford). Evidence or records of 120mm guns at the remaining three batteries were not identified. Seven AAA batteries were located on the North Slope, ten in the central area to the east of the Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE), and two in Riverland. No AAA batteries were located in ALE.

The guns had a maximum horizontal range of nearly 11 miles when fired at a 45° angle with a maximum muzzle velocity. Actual firing data indicate that the guns had a maximum range of about 10.5 miles.

Most of the firing training conducted by the 5th AAA Group was at the Yakima Firing Center (YFC), Washington. However, the 120mm guns were fired on the Hanford Site during the period of assignment for settling, calibration, and verification firing.

Records document that the 120mm guns on Hanford were fired a minimum of 396 times during the period 1950-1952. The average occurrence of unexploded rounds for the total firing documented from 1950 through 1952 (396 rounds) was once. Based on the number of estimated rounds that might fail to explode (i.e., one failure per 396 rounds), and the assumed number of rounds fired during the years 1953 to 1957 (660 rounds), approximately two additional rounds may have failed to explode during the undocumented years of 1953 through 1957. Based on an average annual reported rate of fire (for the documented period of 1950 to 1952), it is possible that the guns were fired over 1,000 times at the Hanford Site during the period 1950-1957.

Evidence of firing has been found in both historical records and on-site visits of the North Slope. A "shrapnel" area has been identified by Westinghouse Hanford employees near the Columbia River on the North Slope. No physical evidence of firing in the Fitzner/Eberhardt Arid Lands Ecology (ALE) Reserve area has been discovered. Physical evidence of firing in the Riverland Area includes discarded clips and empty ammunition cartons for 105mm rounds.

One dud-fired round was reported in the North Slope during the period of 1950 through 1952. Also noted was the destruction of a dud-fired round approximately six months after firing (presumed to be the same round). Firing records for the period 1953 through 1957 were not discovered during the archives search. If the batteries were fired from 1953 through 1957, two duds may have occurred and the possibility of additional dud-fired rounds (unreported, not found) exist at or near the Hanford Site.

Three firing range areas were used by the Hanford Patrol (Figure 8): 1) one located in the southeast end of the North Slope, on the east side of the Columbia River bank, 2) a second still under control of the Hanford security force, located west of the 300 Area, and 3) a third located on the east end of Gable Mountain. The firing range located west of the 300 Area was originally established and used by the Army between 1953 and 1961. Small arms firing ranges likely existed at individual AAA batteries. Field evidence of such activity is documented at three AAA batteries.

Ammunition caches were stored at each of the AAA gun batteries to provide small arms for men on assignment. Each of the 16 AAA gun batteries had at least one ammunition cache.

The U.S. Naval Air Station at Pasco (NAS Pasco) was commissioned in 1942. NAS Pasco controlled 25 airfields, primarily for the purposes of conducting air training. Later in 1943, the training was accelerated to conduct advanced training maneuvers, including dive-bombing, aerial gunnery, and rocket firing. Between one and nine of the twenty-five airfields were designated for practice bombing targets. One of the twenty-five airfields was located within the Hanford Site, near the 300 Area of Hanford. The remaining twenty-four airfields were between 4.8 (3-miles) and 56.5 (35 miles) kilometers south and east of Hanford.

One Nike fuselage was found at a landfill near a former Nike launch site on the North Slope (H-83-L). The U.S. Army Yakima Firing Range Explosive Ordnance Detachment confirmed that the fuselage was not considered ordnance and not a dangerous component. The fuselage was placed back into the excavated landfill and backfilled.

CONCLUSIONS

The most significant OEW hazards for the Hanford Site include ammunition storage areas at AAA batteries and munition caches, small arms firing ranges, and unexploded 120mm rounds. Based on the data reviewed for this study, the ammunition storage areas and small arms firing range locations are known and have been assessed. Potentially three unexploded 120mm rounds were fired during the use of the AAA batteries. One of the unexploded rounds was apparently

found. Two unexploded 120mm rounds may be present on or near the Hanford Site. If these unexploded rounds exist, they may be present in an area of approximately 1,800 square miles. Given the small potential of OEW that may be present over such a large area and that the land use of the site may not significantly change in the foreseeable future, we do not recommend field surveys.

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1.0 INTRODUCTION

This report summarizes work conducted on behalf of the COE Huntsville Division, describing the findings of an archives search for ordnance and explosive waste (OEW) at Hanford.

In April 1990, the U.S. Army Corps of Engineers, Huntsville Division (COE Huntsville Division) was designated the Mandatory Center of Expertise (MCX) and Design Center for Unexploded Ordnance. In 1986, Congress established the Defense Environmental Restoration Program (DERP). Under the DERP program are two subprograms, the Installation Restoration Program, which deals with active installations, and the Formerly Used Defense Sites Program. Under DERP, the goal of the Defense Department is to remediate environmental problems on current and formerly owned or used Defense sites.

The Formerly Used Defense Site Program has three major activities:

1. Remove and dispose of hazardous and toxic waste

2. Demolish and remove the old buildings and debris, and

3. Remove ordnance and explosive waste

The COE Huntsville Division is responsible for the third activity. A team of engineers and other specialists from the COE Huntsville studies sites throughout the country to determine whether ordnance contamination exists. The COE Huntsville Division investigates possible contamination, determines its potential danger, develops a plan to remediate the ordnance problem and serves as the technical manager for the execution of that plan.

The COE Huntsville Division executes site remediation in phases, usually beginning with an archives search. This consists of interviews with local residents and former employees of the former Defense activity, document searches and a site visit. If the archives search confirms an ordnance problem, the COE Huntsville Division proceeds to the next phase, the site investigation (SI). During the SI phase, the COE Huntsville Division conducts surface sweeps in suspect areas to try to visibly detect ordnance, followed by subsurface sweeps with magnetometers to determine if ordnance may be buried at the site.

The purpose of the project was to evaluate existing records, studies, and data concerning ordnance and explosive waste (OEW) contamination at Hanford and identify areas with potential for OEW contamination. Ordnance and OEW includes military supplies such as weapons, ammunition, combat vehicles, and maintenance tools and equipment, etc. The COE Huntsville Division, issued Delivery Order A for Contract DACA87-92-D-0021, on August 19, 1993, to conduct an Ordnance and Explosive Waste Records Search for the Hanford Site (Figure 1).

Portions of the North Slope and Riverland Areas were toured, however the scope of this study did not include field searches for OEW evidence. The results of the research and analyses are presented in this report. The COE Huntsville Division was requested by the US Department of Energy (DOE) to conduct the OEW archive record search. Dames & Moore utilized an in-house ordnance expert to perform the research.

The work conducted for this project was divided into the three following tasks.

1.1 TASK ONE - RECORDS REVIEW AND SITE VISITS

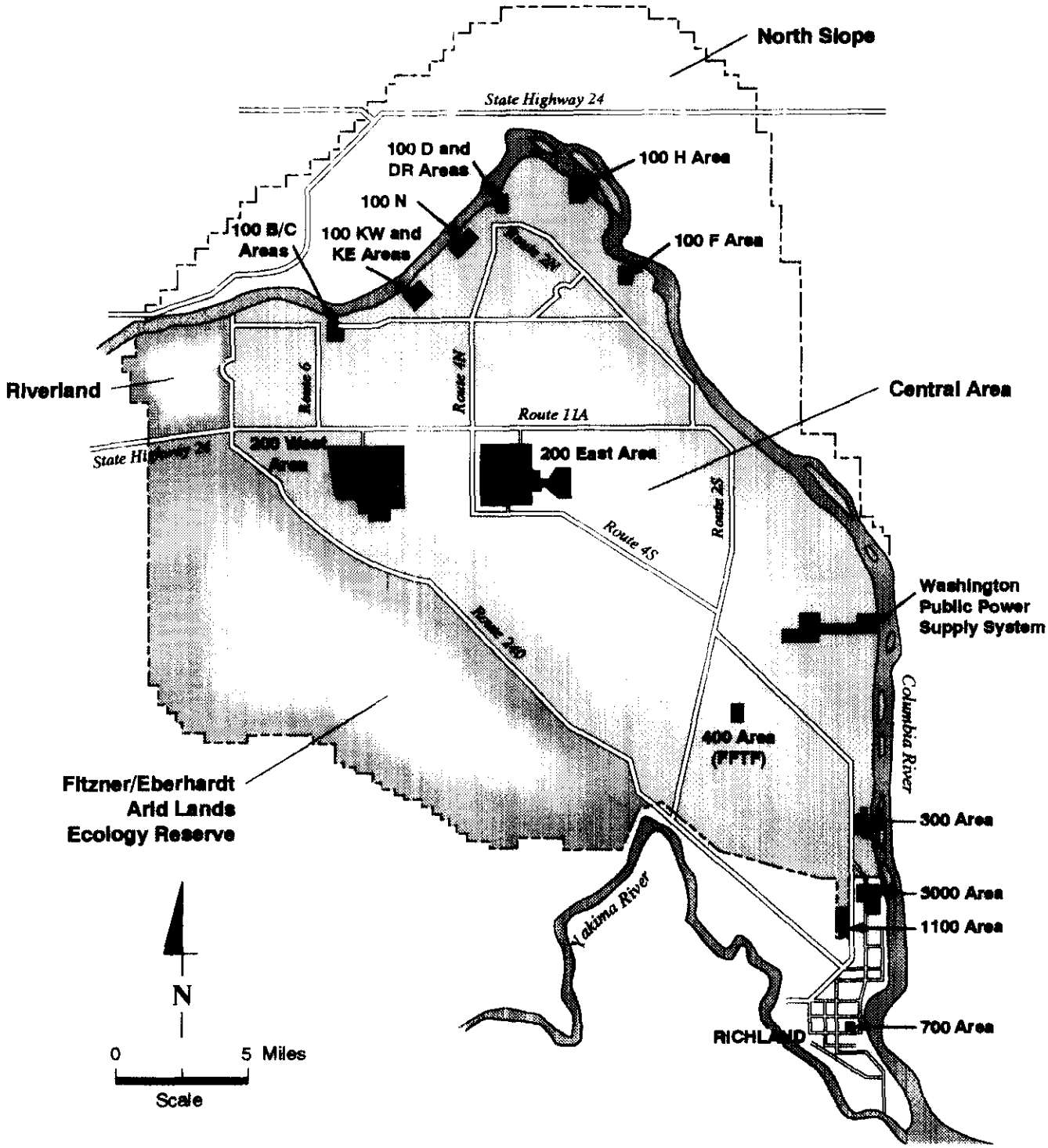
The first task included the collection and review of military documents and records housed at several locations throughout the U.S. These records described Hanford's military occupation; dates of activation and deactivation; tactical training activities; and locations of ordnance that were fired, stored, or disposed of within the study area. Additional information was gained from interviews with the local Hanford populace, former Army military officials, security officers, and contractors familiar with the Hanford Site and the study area. The list of repositories visited and persons interviewed is summarized in Section 4.0 of this report and described in detail in Appendix B.

1.2 TASK TWO - ORDNANCE AND EXPLOSIVE WASTE CONTAMINATION ANALYSIS

This task included the evaluation of data collected in Task One to identify site areas with potential for OEW contamination. Military occupation, weapons use, and firing history was assessed to identify the potential areas of concern. Descriptions of military activities, Hanford weapons and ammunition, locations of firing ranges, and protocol for firing weapons are included in Section 5.0.

1.3 TASK THREE - ARCHIVES SEARCH REPORT

Task three was the preparation of the draft and final archive search reports. This report describes the research methods and findings of the study.



SOURCE: *U.S. Department of Energy, Richland, Washington, 1994*

HANFORD SITE MAP

US Army Corps of Engineers
December 1994 Ordnance & Explosive Waste Records Search
7613-021-005 Hanford, Washington

FIGURE 1

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2.0 SITE DESCRIPTION

The Hanford Site is located in south-central Washington (Figures 2 and 3) and was acquired in 1943 by the Manhattan Engineer District (MED) of the Army Corps of Engineers (COE) through the actions of General Leslie Groves, MED Chief. The goal of the MED was to produce the first nuclear weapons during World War II. General Groves assigned his deputy, Colonel Franklin T. Matthias, to find a suitable location for the production of plutonium for use in nuclear weapons.

In January 1943, the Hanford location was selected and approved by the MED as a good location for several reasons. The Columbia River provided a large supply of clean water to cool the nuclear reactors, and electricity from Grand Coulee Dam was available and inexpensive. The site was in a remote area away from large populations, creating better security and safety in the event of an accident. The Hanford area provided a mild climate, solid ground for heavy structures, and was level land. The site produced plutonium for the world's first nuclear bomb 28 months after construction commenced.

In January 1947, the newly created Atomic Energy Commission (AEC) assumed control of the Hanford Site, and the COE-Seattle District acquired land use permits issued by the AEC. In March and April of 1950, the Army was detached to Hanford to bring military antiaircraft defense to the site (J. Maas, Air Defenses of Camp Hanford Forward Positions, 1993).

The Hanford Site has operated continuously since the 1940's, producing plutonium for nuclear weapons and conducting research and testing with nuclear energy. Military defense occupation occurred from 1950 until 1961. As of July 6, 1962, the AEC terminated the land use permits and agreements with the COE-Seattle, and the AEC accepted the land back "in a condition satisfactory to the Commission [AEC]". Appendix D presents correspondence letters from AEC to the COE-Seattle concerning the transfer of lands. In May 1989, the DOE, the U.S. Environmental Protection Agency (EPA), and the State of Washington signed the Hanford Federal Facility Agreement and Consent Order which established actions to be taken and timelines for these actions to bring the Hanford Site into compliance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA).

Due to the enormous size (approximately 900 square kilometers), varying topographic relief and historical uses of the Hanford Site, four distinct areas have been named to describe specific areas at Hanford, namely the North Slope, Riverland, ALE, and Central Area.

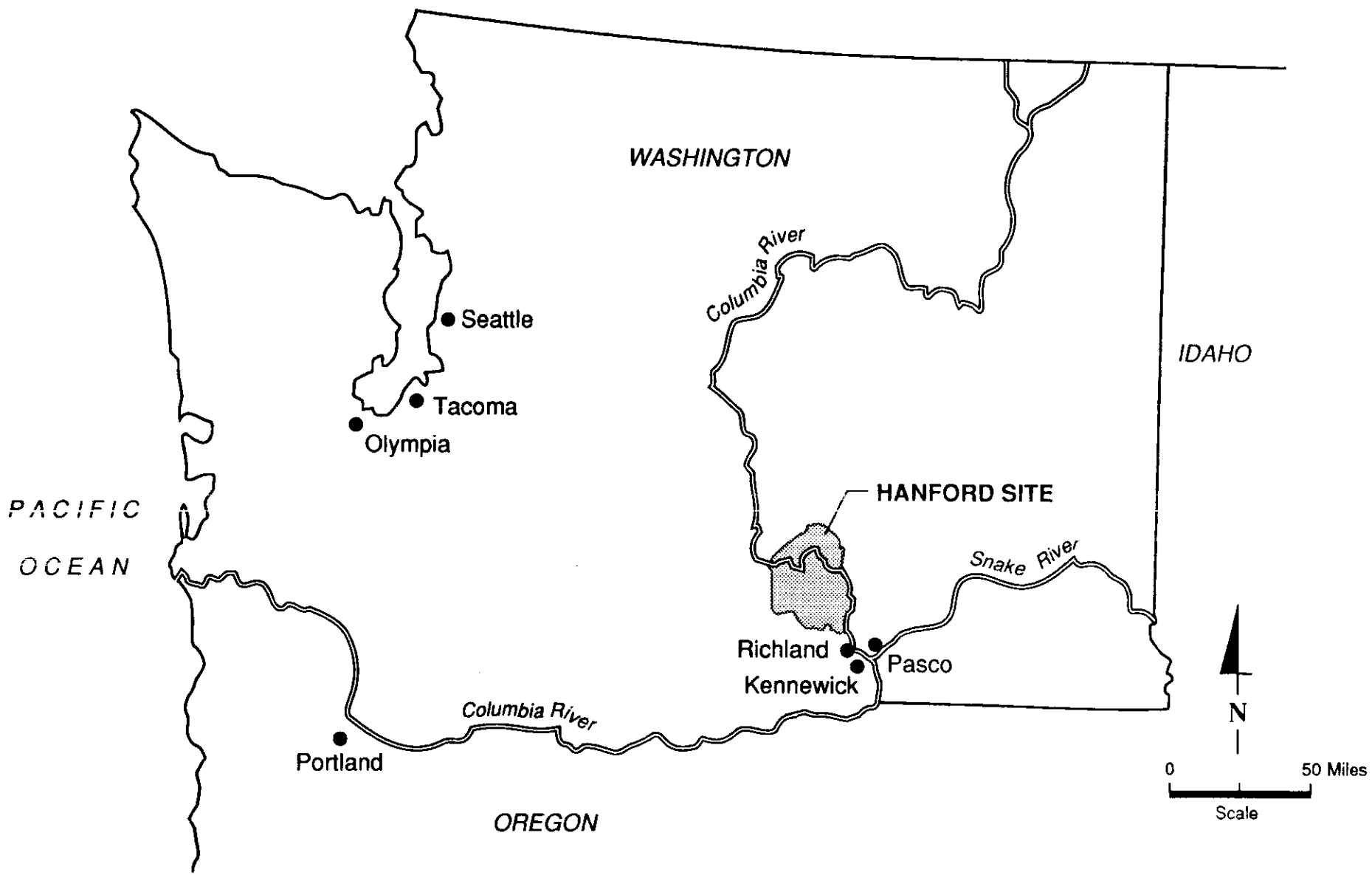
The North Slope

The North Slope, also commonly known as the Wahluke Slope is located on the north side of the Columbia River and occupies approximately 225 square kilometers of land that is currently leased from the U.S. Fish and Wildlife Service and the Washington Department of Wildlife. The North Slope was tribal land for as many as 12,000 years. Several American

Indian nations and tribes used the area for hunting and fishing until the North Slope was homesteaded in the late 1800's. The government took control of the North Slope in 1943 and used it for military air defense installations until 1961. Since 1964, the area has been used for military maneuvers, although there have been no permanent military installations since 1961 (North Slope Expedited Response Action Proposal, February 1994). Between 1974 and 1977, the AEC was involved in the cleanup of some buildings and debris from military installations located on the North Slope (J. Maas, Air Defense of Hanford Sept. 1993). This area was not used for plutonium production. Twenty-five percent of the North Slope, located on its west side is currently managed as a wildlife refuge with limited public access. Certain areas are opened for cattle grazing to ranchers who obtain grazing agreements. The remaining seventy-five percent of the North Slope is open to the public during daylight hours. The Washington Department of Ecology, and the U.S. Environmental Protection Agency (EPA) recommended that DOE prepare an expedited response action (ERA) proposal for at least 10 landfills associated with the former military installations on the North Slope (North Slope ERA, February 1994). As of June 1994, only a fuselage from a former Nike missile was found (Photo 1). The U.S. Army Yakima Firing Range Explosive Ordnance Detachment confirmed that the fuselage was not considered ordnance and not a dangerous component, and was backfilled into the landfill (North Slope Expedited Response Action Proposal, February 1994).

The Riverland Area

The Riverland area encompasses approximately 20 square kilometers of the western portion of the Hanford Site, and is bounded by Washington State Route 240 to the east, Washington State Highway 24 to the south, Hanford Site boundary to the west, and the Columbia River to the north (Photos 2, 3, and 4). The Riverland area has been occupied in the past by military defense sites and military exercises, the McGee Ranch fish farm, and various homestead sites. A small area within the Riverland area is under the jurisdiction of the Bonneville Power Administration. Another portion, in the northeast corner of the Riverland area, was occupied by the Riverland Rail Yard Maintenance Facility. This facility was constructed in 1943, operated until 1954 to support Hanford construction and operation activities, and was the terminus of the Milwaukee Railroad. This area was important to the early development of the Hanford Site because all rail freight destined for Hanford was delivered to this yard. Decontamination of low levels of radioactive material was conducted at Riverland on the rail car wheels, axles, and other undercarriage parts until 1956. The facility was decontaminated in approximately 1963. Approximately 0.61 meters (2 feet) of soil covers the building foundations, which were tested to have natural background radiation levels. Various military explosives were stored in a munitions cache in the 1970's at Riverland. This cache consisted of one wooden box buried 0.61 meters (2 feet) deep in the ground. The cache and contents were destroyed at the Yakima Firing Range after it was removed (Riverland Expedited Response Action Proposal, April 1993). Between 1974 and 1977 the AEC was also involved in the cleanup of some buildings and debris in the Riverland Area (J. Maas, Air Defenses of Hanford, Sept. 1993). Debris piles, cisterns, irrigation pipe, and fence wire mark the areas of various homestead sites. There is also a water distribution system consisting of plastic-lined



VICINITY MAP

US Army Corps of Engineers
December 1994 Ordnance & Explosive Waste Records Search
7613-021-005 Hanford, Washington

SOURCE: U.S. Department of Energy, Richland, WA

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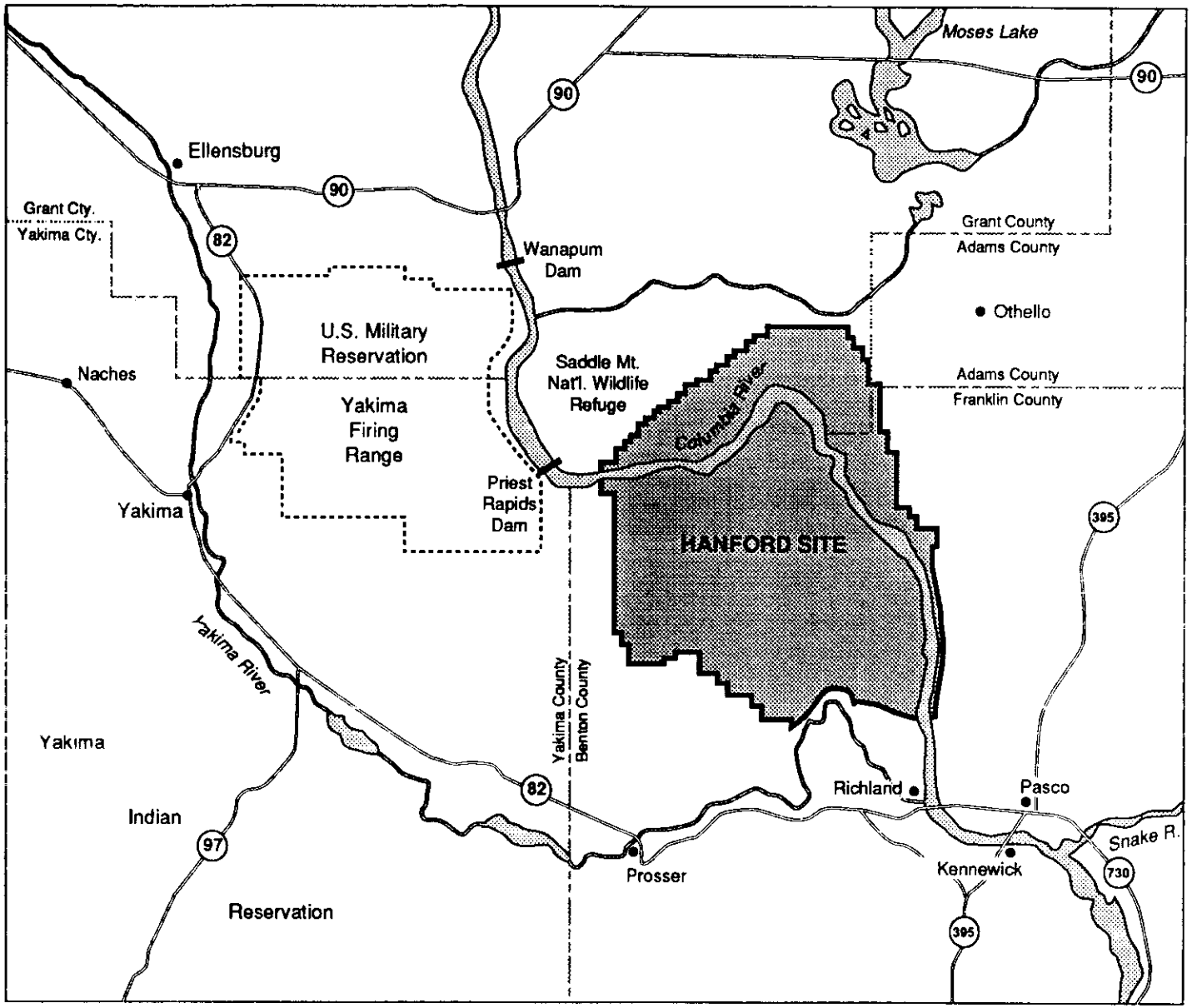

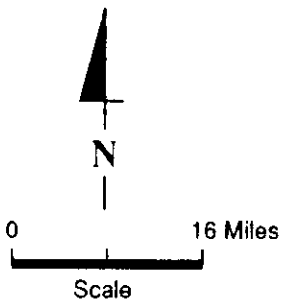

REGIONAL LOCATION MAP

US Army Corps of Engineers
December 1994 Ordnance & Explosive Waste Records Search
7613-021-005 Hanford, Washington

SOURCE: American Automobile Association, 1992

FIGURE 3

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ditches with connecting plastic pipes near the McGee Ranch site located in the southeast corner of Riverland (Riverland Expedited Response Action Proposal, April 1993).

The ALE

The ALE, recently named the Fitzner/Eberhardt Arid Lands Ecology Reserve, consists of 194 square kilometers of land on the western portion of the Hanford Site. ALE was renamed to commemorate two scientists for their achievements and contributions to wildlife studies conducted in the area. Mr. Richard E. Fitzner and Mr. Lester E. Eberhardt, recognized Pacific Northwest Laboratory research scientists, died in a plane crash while studying wildlife near Yakima in 1992. The ALE is located south of Washington State Highway 240 and east of the Yakima River. Following the presence of Indians in the 1800's, homesteading was a common occurrence in the 1890's, including raising livestock and planting small gardens. The homesteads that succeeded depended on grazing or sheep raising activities. This was an important winter grazing range for sheep from the mid 1880's through 1942. Snively and Benson Ranches were the two notably successful ranches in this area that cultivated grain for winter livestock feed. Water was piped 4.8 kilometers (3 miles) from Rattlesnake Springs to the Benson Ranch and used to produce alfalfa. Natural gas was discovered on ALE in the early 1910's. The Rattlesnake Hills Gas Field was developed for commercial use after 1929. Gas production ceased in 1941, after the supply had been depleted from the limited pockets formed in volcanic deposits. While the gas fields were in operation, caretakers and their families lived in the area. Since 1943, when the government took control of the land, access by the general public has been limited. No plutonium production facilities, or raw materials were manufactured or stored at the ALE Reserve. The ALE was used as a buffer zone between publicly-owned lands and the production facilities located near the Columbia River. One Nike site (H-52) was constructed in the mid 1950s, and located in the southwest portion of the ALE Reserve. The Nike operations ceased in early 1961. Other military activities occurred in 1963, with a large practice maneuver involving 60,000 troops. The maneuver is referred to as Operation "Brave Shield" and it took place over a period of several weeks. In 1967, the U.S. Atomic Energy Commission (AEC) set aside ALE to preserve the shrub-steppe vegetation. The area has been used for ecological research and educational purposes since that time (Preliminary Assessment Screening Report for the ALE Reserve, April 1994).

The Central Area

The Central Area of Hanford includes approximately 465 square kilometers of land and is bounded to the north and east by the Columbia River, and to the south and west by Washington State Highway 240. Not unlike the previous areas described above, Indians were the earliest inhabitants of the Central Area, with homesteading concentrated along the north and eastern portions near the Columbia River. In 1943, the Central Area was the hub of nuclear production activities. In less than two years, the first reactor at the Hanford Site was started. By 1945, the central area was occupied by three nuclear reactors, three chemical processing plants, five coal-fired power plants, nuclear fuel fabrication, and other support facilities. A numbering system was developed in the 1940's, designated for particular functions within the

Central Area. The lowest number was assigned where the processing began, the 100 Area. The 100 Area, along the Columbia River, was the site for DOE's production reactors. The 200 East and West Areas provided process facilities for the reactors. The 300 Area contained the Fuel Fabrication Facilities to support the 100 Areas and other research and support laboratories. The 400 Area is the newest part of the Hanford Site and contains the Fast Flux Test Facility, which houses a sodium-cooled reactor. The 600 Area covers the remaining undesignated areas of the Hanford Site. The 1100 and 3000 Areas are for the general support facilities, such as warehouses, a bus lot, and purchasing. Several military installations were established in the Central Area to support the air defense requirements at the Hanford Site until the late 1950s and possibly into 1961.

In the 1960s and early 1970s, all but one of the nine reactors was closed (only N Reactor remained). During that time, alternative energy sources were being studied. Plutonium production came to a halt from 1972 to 1983, when the site's only fuel processing facility was shut down. Plutonium production resumed in 1983, generating additional waste until 1987 when it was shut down. In 1989, the DOE administration in Washington D.C., began to redefine the mission at the Hanford Site with a major emphasis on environmental restoration and waste management programs. At the same time, to meet the long range cleanup goals at Hanford, studies beyond current technologies and innovations are being conducted.

The following sections describe the topography, climate, and geology of the Hanford Site.

3.0 HANFORD SITE TOPOGRAPHY AND GEOLOGY

The Hanford Site is located in south-central Washington, in a remote, rural part of the state (Figures 2 and 3). The site is approximately 900 square kilometers (Figure 2). The Columbia River forms the southeastern border of the site and flows through the northern portion of the site. The river separates the central Hanford Site area (includes the central portion of Hanford, the Riverland Area, and the ALE from the northern portion of the Hanford Site, which is known as the North Slope (Figure 1). The Hanford Site encompasses portions of four Washington counties: Benton, Franklin, Grant, and Adams.

The climate of the Hanford Site area is semi-arid with an average of 6 inches of annual precipitation. Vegetation in the area consists primarily of desert shrubs and grasses. The cool winter climate, the remoteness of the area, and the presence of the Columbia River were major factors in the decision to locate the Hanford Site in the area (Gerber, 1992).

3.1 TOPOGRAPHY

Hanford is located within the Pasco Basin within the Columbia Plateau (Delaney, 1990 and Reidel, et al., 1992). The Pasco Basin is a broad, low-relief area located in south-central Washington. The Pasco Basin is bordered to the north by the Saddle Mountains, to the west by the Umtanum and Yakima Ridges and the Rattlesnake Hills, to the south by Rattlesnake Mountain, and to the east by the Palouse Slope. Site elevations range from approximately 400 feet Mean Sea Level (MSL) elevation near the Columbia River to approximately 3,500 feet elevation at the Rattlesnake Mountain summit.

- North Slope

  The North Slope varies from relatively broad, flat areas along the northern banks of the Columbia River, to steep bluffs and ridges further north closer to the Saddle Mountains. Elevations range from 400 feet MSL near the river to over 1,700 feet MSL in the Saddle Mountains (Rockwell, 1979).

- Central Area

  The central portion of the Hanford Site is generally a flat, low-relief area with the exception of the Gable Mountain anticline located in the northern part of this area (Delaney, 1990, and Reidel, et. al., 1992). Gable Mountain rises to approximately 1,100 feet elevation MSL.

- Riverland Area

  The Riverland area varies from small, flat-lying areas along the eastern boundary (adjacent to Highway 240) to comparatively steep-sloped hills and ridges (Umtanum Ridge) along the western Benton County boundary. Elevation varies from 800 feet

MSL adjacent to Highway 240 to over 2,400 feet MSL at the Benton/Yakima County border (Rockwell, 1979).

- ALE Area

  The ALE area varies from a flat to gently sloping area at the eastern boundary (near Highway 240) to very steep ridges at the summit of Rattlesnake Mountain. Elevations vary from 500 feet MSL near Highway 240 to over 3,500 feet MSL at the summit of Rattlesnake Mountain (Rockwell, 1979).

3.2 GEOLOGY

Four major geologic processes have affected the general land surface characteristics of the Hanford Site: 1) uplift of anticlinal ridges; 2) flooding that occurred during the Pleistocene Epoch (10,000 to 20,000 years before present); 3) wind blown and fluvial erosion and deposition during the Holocene Epoch (10,000 years ago to the present); and 3) ancient and recent landslides. Regional geologic uplift began during the Miocene Epoch (25 million years ago) and continues to the present.

The Hanford Site is underlain by Miocene-aged basalt belonging to the Columbia River Basalt Group (Delaney, 1990, and Reidel, et. al., 1992). The Columbia River Basalt Group has been divided into five formations. The three youngest formations are exposed within the Hanford property: the Grande Ronde Basalt; the Wanapum Basalt; and the Saddle Mountains Basalt.

Sedimentary bedrock formations at the Hanford Site include the Miocene/Pliocene-aged (25 to 1.7 million years old) Ellensburg and Ringold Formations, and the Quaternary-aged (1.7 million years old to recent) Hanford Formation (Delaney, 1990; Reidel, et. al., 1988 and 1992; and Rockwell, 1979). These formations are present locally at the ground surface. The Hanford Formation is divided into two members: coarse-grained deposits called the Pasco Gravels and fine-grained deposits called the Touchet Beds. The Ringold Formation crops out in areas of the North Slope, and the Ellensburg Formation crops out in areas of the Riverland Area, Rattlesnake Hills, and the North Slope.

Quaternary-aged surficial deposits mantle most of the Hanford and surrounding areas. These deposits consist of wind blown dust; rock fragments at the base of cliffs; rock fragments and soil deposited by sheetwash and downslope creep; alluvial clay, silt, sand, and gravel deposited by streams; landslide deposits; and alluvial fan deposits.

- North Slope

  The surficial geology of the North Slope generally consists of Pleistocene flood deposits of the Hanford Formation (Reidel and Fecht, unpublished). The flood deposits include lake deposits with layers of ice-rafted cobbles and ash from the

Mount St. Helens eruption. These deposits have been identified adjacent to the Columbia River, as high as 1,200 feet in elevation up the North Slope, and up to 6.1 meters (20 feet) thick in flat-lying areas. Gravel flood deposits are located at the southwest portion of this area. The Ringold Formation is present in the southeast portion of the North Slope and consists of laminated to bedded clay, silt, and sand. Stabilized sand dunes are present in the south-central portion of the North Slope and consist of Holocene sands. This area is underlain at depth by Miocene basalt.

- Central Area

  The surficial geology of the southern portion of the Central Area consists predominantly of Holocene, stabilized sand dunes and interbedded, fine- to medium-grained sand. The northern portion consists of Pasco Gravels of the Hanford Formation and Holocene sands similar to those in the southern region. Gable Mountain is located in the north-central portion of the Central Area and forms the predominant geomorphic feature of this area. Gable Mountain is characterized as a northwest-trending anticlinal feature composed of the Elephant Mountain Member of the Saddle Mountain Basalt. These basalt are believed to be at depth underlying the surficial geologic units.

- Riverland Area

  The surficial and bedrock geology in the Riverland Area includes Quaternary deposits and Miocene basalt according to Reidel and Fecht (unpublished). Deposits along the south bank of the Columbia River include alluvium of varied composition and thickness, alluvial fans, and gravel flood deposits. South of the river bank deposits (inland from the river), exposed bedrock includes the Elephant Mountain, Pomona, and Umatilla Members of the Saddle Mountains Basalt; the Priest Rapids, Roza, and Frenchman Springs Members of the Wanapum Basalt; and the Grande Ronde Basalt.

- ALE Area

  The surficial and bedrock geology of the ALE Area is complex and varied according to Reidel and Fecht (unpublished). Quaternary-aged surficial deposits include alluvium, gravel flood deposits, Mount St. Helens Ash, wind blown silt and sand, silt, flood deposits, alluvial fans, and landslides. The Quaternary-aged deposits are riddled with Miocene-aged basalt flows: Elephant Mountain, Umatilla, and Pomona Member basalt, and the Esquatzel, Roza, and Frenchman Springs Member basalt.

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4.0 HANFORD ORDNANCE AND EXPLOSIVE WASTE RESEARCH

Dames & Moore visited several information depositories and interviewed a number of individuals with knowledge of Hanford operations and ordnance use. The following sections (in chronological order) identify the facilities where research was conducted, lists individuals that were interviewed, and provides a summary of the work performed. A bibliography of the documents used in this study is presented in Appendix A, and more descriptive details concerning the research that was performed are included in Appendix B.

The scope of work developed by the COE Huntsville Division identified information depositories at Hanford in Richland, Washington; the U.S. National Archives and Records Administration (NARA) and COE Office in Seattle, Washington; the COE Office in Huntsville, Alabama; and the NARA in Washington, D.C. During the course of Dames & Moore's work, these facilities were visited. Additional archive repositories were identified as possible sources of military records. Additional research was performed at the Suitland Reference Branch, NARA in Suitland, Maryland; the Army Military History Institute, Carlisle Barracks, Pennsylvania; and the NARA in Atlanta, Georgia. The Army Air Defense Center at Fort Bliss, Texas was also contacted. A number of individuals were interviewed at each of these locations.

4.1 ARCHIVE CONTACTS

Washington State University, U.S. Department of Energy, Public Reading Room, Richland, Washington

- Conducted an archive search of the Washington State University, DOE, Public Reading Room in Richland, Washington on November 16, 1993. This facility contains documents prepared for, or by the DOE, related to the Hanford Site.

- Reviewed indexes and identified several books and other published material on the Hanford Nuclear Plant. Documents reviewed included a historical perspective on how the site was selected, land uses prior to its occupation, the production of nuclear energy, the scientists involved in the production of nuclear fission, the work to produce the first nuclear bomb, and the contamination that resulted from the nuclear production activities. Books were not found to indicate the history of military defense activities relative to antiaircraft artillery, or Army records of the specific battalions activated to defend the Hanford Production Plant.

Army Corps of Engineers, Hanford Program Office, Richland, Washington

- Visited the COE, Hanford Program Office in Richland, Washington and met with Mr. Walter Perro, Unit Manager for the North Slope and ALE Reserve, on November 18-19, 1993. Mr. Perro provided numerous Hanford documents, reports, maps, and a list of several people to interview. Reports provided by Mr. Perro described the construction history of the Manhattan Project Buildings and Facilities

at the Hanford Site, the North Slope Expedited Response Action Proposal, and records of Nike missile sites.

Westinghouse Hanford Company, Environmental Resource Center, 740 Building, Richland, Washington

- Conducted a review of the Environmental Resource Center at Westinghouse Hanford Company on November 16-18, 1993. Westinghouse Hanford Company is the operations and engineering contractor leading cleanup and environmental restoration of Hanford. The Westinghouse Hanford Company documents that were reviewed related to the contamination associated with the nuclear production and described geology, hydrology, and an aerial radiological survey of the Hanford Site.

- Interviewed Mr. Richard Roos, Manager, Site Remediation Section, For Westinghouse; Dr. Stephen Reidel, lead geologist for Westinghouse; Mr. Jonathan Lucas, Westinghouse Engineer; Mr. D.H. DeFord, Westinghouse Historian; and Mr. Paul Valcich, Westinghouse Engineer.

Westinghouse Hanford Company, Record Holding, 712 Building, Richland, Washington

- Visited the Record Holding office on November 17, 1993. The Record Holding office contains historical maps and aerial photographs of the Hanford Site. Photographs dated between 1951 and 1952 were reviewed but none of the photographs showed coverage of military operations, evidence of ordnance related activities or weapon ranges.

ICF Kaiser Engineers Hanford Company, 200 East Area, Survey Office

- Visited the Survey Office of the ICF Kaiser Engineers Hanford Company on November 17, 1993. ICF Kaiser Engineers Hanford Company provides architect-engineer and construction services for the Hanford Site. Several survey drawings dated from 1952 to 1959 which illustrated the locations of military positions and ammo storage areas at Hanford were reviewed.

U.S. Soil Conservation Service, Franklin County, Washington

- Visited the Franklin County Soil Conservation Service office on November 16, 1993, and received soil classification descriptions for the various soil types identified at Hanford.

U.S. Soil Conservation Service, Benton County, Washington

- Visited the Benton County Soil Conservation Service office on November 17, 1993, and received soil classification descriptions for the various soil types covering the Benton County Area.

MACTEC, Richland, Washington

- Interviewed former DOE Safety Officer, Mr. Jerry Yesberger, at MACTEC on November 17, 1993. Mr. Yesberger provided information about a practice range near Gable Mountain.

Richland Police Department, Richland, Washington

- Interviewed Lieutenant Panther, Bomb Disposal Leader on November 17, 1993, to identify whether the Richland Police Department had records pertaining to exploded or unexploded ordnance. Lieutenant Panther was not aware of any incidents related to Hanford and ordnance issues.

Army Corps of Engineers, Seattle, Washington

- Interviewed Hanford military history researchers: Mr. Jonathan Maas, Environmental Protection Specialist; and Dr. David Rice, Chief, River Basin Studies on November 30, 1993. Several site visits had been made by Mr. Maas and Dr. Rice between 1986 and 1990. They had also conducted interviews with area residents and were interviewed and/or participated in field searches at Hanford. Extensive notes on observations, documents, informant recollections, and site photographs were collected and provided. Mr. Maas had investigated rumors of Hanford munitions located at Hanford. Evidence of the "stashes" were never found. Dr. David Rice has been involved in conducting research at Hanford pertaining to archaeological and cultural resources issues.

U.S. National Archives and Records Administration, Pacific Northwest Region, Seattle, Washington

- Visited the NARA on November 30 and December 1, 1993. Hundreds of documents from the General Service Administration, Real Property Division; War Assets Administration; and Accession were reviewed. These documents provided a listing of owners, acreage, and lease agreements in Pasco, Washington. No significant findings specifically related to Hanford military activities were identified that were not already provided by Mr. Maas and Dr. Rice.

Fort Lewis Explosive Ordnance Disposal (EOD), Fort Lewis, Washington

- Interviewed Staff Sergeant Udelhofen on December 2, 1993, who was on-site at the North Slope about three years ago. He did not recall of any incidents related to unexploded ordnance.

Fort Lewis Museum, Fort Lewis, Washington

- Contacted the Fort Lewis Museum on December 2, 1993, and determined that they did not have military records, historical photographs, or artillery information related to Hanford.

Army Corps of Engineers, Huntsville, Alabama

- Met with Mr. Charles Heaton, COE Project Manager on December 7-8, 1993, to review files that pertained to the military records and types of ordnance used by the Army. Mr. Jeff Neece, Safety Specialist (former EOD), was also interviewed to identify technical information regarding the munitions found at Hanford.

Public Meeting, North Slope Expedited Response Action, Mattawa Elementary School, Mattawa, Washington

- Attended a public meeting on December 14, 1993, that focused on plans to cleanup the North Slope. Presentations were made concerning military history; potential environmental and physical hazards relating to possible ordnance-related contamination; and plans to open the area up for alternative uses.

Hanford Field Trip of the North Slope Study Area

- Attended a field trip to the North Slope on December 15, 1993. Mr. Richard Roos, Manager, Site Remediation Section, of Westinghouse Hanford Company, conducted the trip.

Hanford Field Trip of the Riverland Study Area

- Attended a field trip to the Riverland Area on December 15, 1993. Mr. Paul Valcich, Engineer of the Area Remediation Section at Westinghouse Hanford Company, conducted the trip. Mr. Valcich provided information concerning the history of military activities and military waste at the Riverland Area.

Westinghouse Hanford Company, Environmental Resource Center, 740 Building, Richland, Washington

- Interviewed Michelle Gerber, PhD., Westinghouse Historian on December 16, 1993, for military history information. Dr. Gerber provided a list of antiaircraft battalions at Hanford, as well as numerous historical articles and documents regarding site activities, daily operations and personnel at Hanford.

Battelle/Pacific Northwest Laboratory, Richland, Washington

- Battelle/Pacific Northwest Laboratory is a national laboratory and the research and development center for Hanford. Dames & Moore interviewed Mr. Lee Rogers, ALE Reserve Manager, and Mr. Charlie Brandt, Biologist for the Riverland Area on December 16, 1993, to obtain information on small arms, training mines, and fox holes located in the Riverland Area.

Mid-Columbia Library, Richland Branch, Van Giesen Way, Richland, Washington

- Visited the Richland Branch Library on December 15, 1993, to review indexes for books, articles, or relevant military history on Hanford. No significant information pertinent to this study was found.

Battelle/Pacific Northwest Laboratory, Richland, Washington

- Interviewed Ms. Mona Wright, Battelle Archeologist, and Mr. George Last, Battelle Geologist and Manager of Cultural Resources, on December 14, 1993. Ms. Wright and Mr. Last had found evidence of ordnance in the study areas. Aerial photographs maintained by the Battelle Cultural Resources Division were also reviewed.

Battelle/Pacific Northwest Laboratory, Richland, Washington

- Interviewed Ms. Natalie Cadoret, Geologist, on December 17, 1993, to discuss findings of ordnance at the ALE Reserve.

U.S. National Archives and Records Administration (NARA), Washington D.C.

- Visited the NARA which is the central repository location for many military records on January 4-5, 1994. This facility housed records of administrative actions, intelligence and security information regarding the Army's role in the development and production of nuclear weapons. Specific data relative to military records and ordnance issues were not identified.

U.S. National Archives and Records Administration, Suitland Reference Branch

- Reviewed records from the NARA, Suitland Reference Branch, on January 4-6, 1994 located in Suitland, Maryland. Command Reports and daily journal notes from 1950 to 1953 of the 5th Group, Battalion 501st, 518th, 519th, 83rd and 770th were reviewed.

Army Military History Institute, Carlisle Barracks, Pennsylvania

- Visited the Army Military History Institute at Carlisle Barracks on January 11, 1994. This repository has an extensive inventory of general military records. Documents were reviewed that identified when the specific groups were deactivated from Hanford defense posts.

U.S. National Archives and Records Administration, Atlanta, Georgia

- Reviewed the information held at the Atlanta NARA repository on January 12, 1994. Although numerous documents were available, no information regarding ordnance or related Hanford operations was discovered.

U.S. Army Air Defense Artillery Center, Fort Bliss, Texas

- Interviewed several research specialists and an archivist on April 11-13, 1994, from the Army Air Defense Artillery (ADA) School Library, ADA Museum, ADA Magazine and the ADA Central Library. Information available from this source pertained to post-1970's Nike installations at various facilities in the U.S. Site specific information for Hanford activities was not identified.

U.S. Army Corps of Engineers, Tri-Services Cultural Resources Research Center, Champaign, Illinois

- Interviewed Mr. Jim Eaton, Research Assistant with the Tri-Services Cultural Resources Research Center on August 16, 1994. Mr. Eaton provided details of the Nike missile program, including the number of magazine storage areas, number of missiles kept on hand at each launch site, and verification of the military units commissioned at the four Nike batteries.

4.2 INTERVIEWS

Dames & Moore conducted a number of interviews throughout the course of the research. The following is a list of the individuals that were contacted. A brief description of each interview is included in Appendix B.

Lieutenant Colonel Edwards of the Yakima Training Center Headquarters

Sergeant Hathaway, 53rd Ordnance Detachment, Explosive Ordnance Officer

Sergeant Wallace, 53rd Ordnance Detachment, Explosive Ordnance Officer

Mr. Lyle Gilk, DOE Security Officer

Mr. Gary Stedman, Supervisor, Environmental Resources Branch, Fort Lewis

Mr. John Weller, Fort Lewis Range Control Officer

Mr. Jim Hoffman, Former Yakima Firing Range Officer

Sheriff Mike Shay, Grant County Sheriff

Sergeant Moorland, retired from the Grant County Sheriff Department

Ms. Helen Fancher, Grant County Commissioner

Mr. Mark Hedman, a local farmer and resident of the Hanford area

Mr. Jim Eklund, a local farmer but formerly with Battelle in Hanford

Mr. Ed Ekenberg, Army Camp Hanford, retiree

Mr. Dib Goswami, Project Unit Manager and Hydrogeologist for the Washington Department of Ecology, Hanford Project Office in Kennewick, Washington

Mr. Dan Warby, former Military Police, 62nd Detachment

Mr. Bill Houchin, City of Richland Fire Inspector

Major Lorin Cyr, Manager of the Patrol Operations Center, Hanford Patrol

Mr. Dick Melbihess, Principle Engineer of Fire Protection at Westinghouse

Mr. Charles Pasternak, DOE Landlord Program Manager

Mr. Eugene Turner, former Army soldier and Hanford Patrol Officer

Mr. J. McHale, a resident of Richland, Washington, and a retired AEC Security Officer who was Chief of Inspection Branch during Army occupation in 1943 to 1948, Deputy of Security, 1948 to 1952, and Director of Security from 1952 to 1972

Mr. Spencer Compton, a retired ICF Kaiser Engineers Surveyor and Hanford Patrol Officer at Hanford

5.0 MILITARY PRESENCE AT THE HANFORD SITE

5.1 MILITARY HISTORY OF HANFORD SITE

The archive and interviews information listed in Section 4.0 were evaluated to develop a military history of the Hanford Site. The following sections summarize Hanford's military history, use of weapons, and evaluation of the potential field of fire.

5.1.1 DuPont Patrol and the Military Police at Hanford

Hanford patrol officers were assigned to the Hanford Site about the same time the construction activities were started. The first noted documentation that the patrol officers were employed was in mid-1943. These officers were employed by the DuPont Company, the company charged with the production of nuclear weapons at Hanford, and were called the Dupont Patrol. The commander in charge of the Army, Colonel F.T. Matthias, decided that an established military patrol station was needed in addition to the DuPont Patrol. Military police (MPs) were assigned as guards except in restricted buildings where DuPont Patrol could be stationed. In 1944, the Army decided to assign MPs to patrol the perimeter of the Hanford Site. Strategic planning for the protection and defense of the locations around Hanford in the event of an emergency was also undertaken. By August 1944, the patrol functions were turned over to the Army. MPs were assigned .45 caliber revolvers. Also in 1944, four in-board boats were assigned at Hanford for patrol use along the Columbia River. The first MPs assigned to Hanford were not actually trained as MPs and were later assigned to MP driver positions. Thirty trained MPs were requested to be assigned to secure Hanford in mid-1945 (Matthias 1942-1945).

5.1.2 Naval Air Station Weapons Use

The U.S Naval Air Station at Pasco (NAS Pasco), situated approximately 4 kilometers north of Pasco, Washington, was commissioned in July 1942. NAS Pasco encompassed approximately 2,220 acres was operated by the Navy, and controlled approximately twenty-five airfields (Outlying Fields NAS Aviation Base Map, 1942 and 1945). Records name nineteen of the airfields: Wheatland, Baxter, Jackass, Esquatzel, Fruitvale, Pylons, Glade, Acton, Sage, Fox, Franklin, Benton City, Richland, Columbia, Horse Heaven, Kennewick, Burbank, Patterson Ridge and Finley (Higley, U.S. Naval Air Station, 1945). Originally, the primary function of NAS Pasco was to conduct air training. In December 1943, the Navy's new objective was to operate and maintain a base for naval aircraft units and aviation personnel, and to conduct advanced training maneuvers. This advanced training including dive-bombing, aerial gunnery, and rocket firing. Conflicting information was found concerning the number of actual outlying fields used for bombing. According to Navy records, nine outlying fields (fields names not listed) were designated for practice bombing targets (Lieutenant Higley, 1945). According to Colonel Matthias' diary, only one airfield (Horse Heaven) was actually used by the Navy as a bombing range (Matthias 1942-1945). Field evidence indicates one former airfield (Fruitvale) located approximately 1-mile west of the 300 Area at Hanford was a bombing training range.

The area is about 50 to 100 acres in size. It is littered with several large pieces of "practice bombs." The items are constructed of thin sheet-metal which can be easily bent with manual pressure and appears to be the size of 250 pound bombs. The items are completely hollow. There are no nose or tail fuzes nor evidence of the use of spotting charges in the nose. In some cases, the items collapsed upon impact without fragmenting leaving recognizable tailfins and noses. Also, filler caps were found in the nose which were possibly used to fill the practice bombs with sand or water. It is conjectured that this bombing range "predates" Hanford and was used by NAS Pasco (Personal Communication R. Ross, and W. Perro, 1994). The remaining twenty-four airfields identified in the Navy records were not located within the Hanford Site, but were between 4.8 (3-miles) and 56.5 (35 miles) kilometers south and east of Hanford (Figure 4).

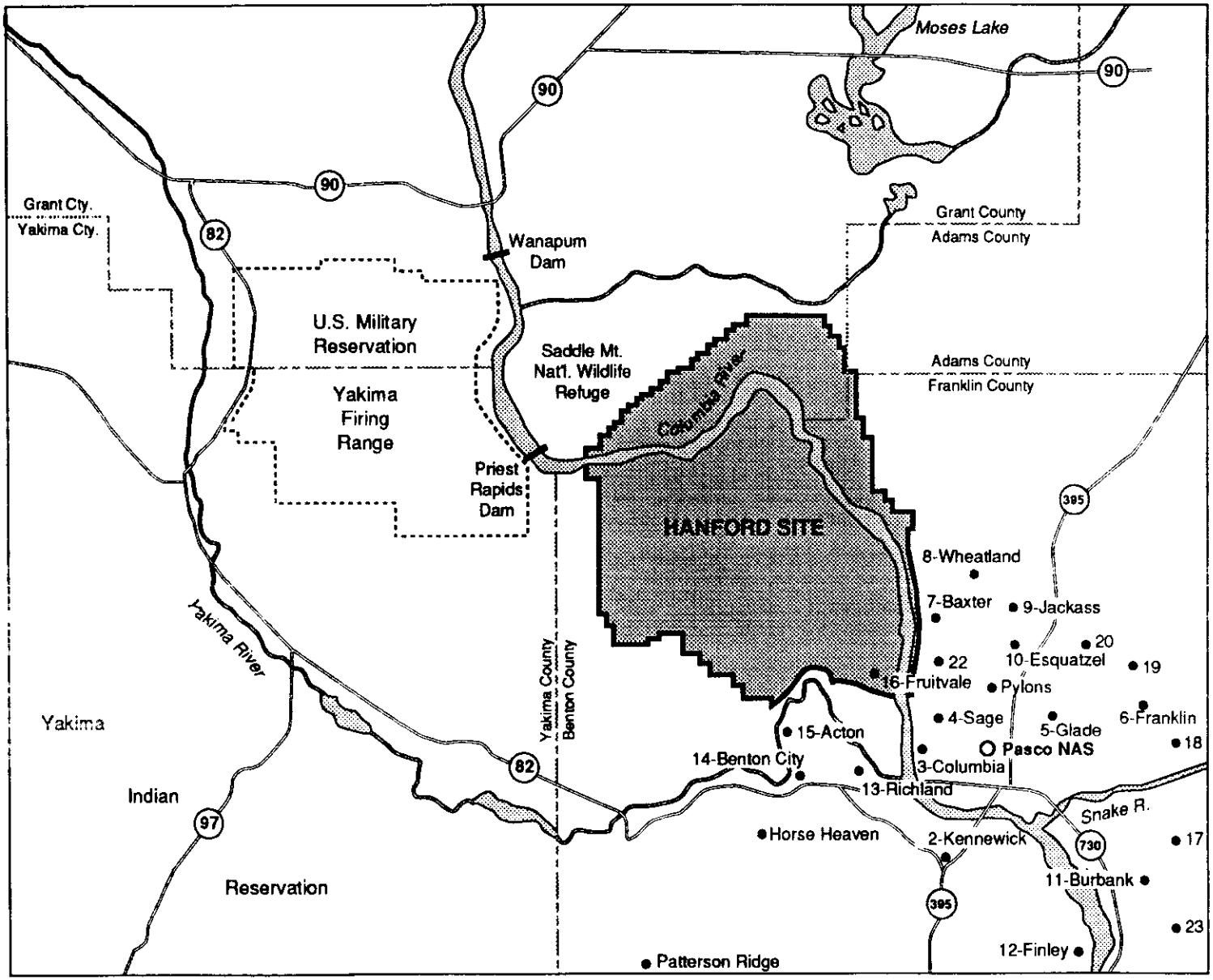
The Army activities conducted at Hanford, and decisions made by Colonel Matthias took precedence over the proposed plans of the Navy. As noted in both the Naval records and Colonel Matthias' diary, the commanding officers from the Army and Navy communicated frequently and coordinated activities effectively to control the airspace around the Hanford Site as early as 1942 when the Naval Air Station was commissioned. There were reports of occasional stray planes flying over the Hanford Site. These occurrences were due to navigation errors of training pilots. The pilots were identified and reprimanded. In 1944, an unarmed navy plane crashed east and south of the 200 East Area at the Hanford Site. The pilot was participating in an air show and lost control of his plane (Matthias 1944). After considerable deliberation between the Navy and the Army, in August 1943 the Horse Heaven Hills was approved for carrier squadron training. It was stipulated that only firing of .50 caliber or smaller ammunition was permitted. The Navy agreed to enforce severe disciplinary action to Navy pilots who flew over the restricted air space covering the Hanford Site.

5.1.3 Antiaircraft Artillery Units (1950-1958)

The Army maintained an active antiaircraft artillery group at the Hanford Site during the period of 1950 through 1958. Camp Hanford was officially established March 28, 1951 and was deactivated March 31, 1961. However, an undocumented World War II AAA position dating from the early 1940's was identified in the Central Area, northeast of Gable Butte during a previous field investigation (J. Maas, Personal Communication). Evidence of a military presence included packing boxes and storage tubes for 120mm artillery rounds, ammunition crates dated 1943, and several deteriorating wood structures (J. Maas, Personal Communication).

In preparation for the eventual assignment to the Hanford Site (also identified as North Richland in some Command Reports), the Commanding General of the Sixth Army, Mark Clark, authorized the reactivation of the 5th AAA Group in 1948 (8 October 1948, TO&E 44-12). In 1948, the 5th AAA Group was attached to the 31st AAA Brigade with the following subordinate units:

501st AAA Gun Battalion (120mm)
518th AAA Gun Battalion (120mm)



NOTES:

1. *Sites with names & airfield numbers 1-16, as well as Pylons Airfield, were identified from Source #4.*
2. *Sites with airfield numbers 1-20 & 22 & 23 were identified from Source #2.*
3. *Patterson Ridge Airfield was identified from Source #3*
4. *Horse Heaven Airfield was identified from Source #5.*

N

0 16 Miles

Scale

SOURCES:

1. *American Automobile Association, 1992*
2. *Outlying Fields, NAS Aviation Base, Pasco, WA, 1942*
3. *History of U.S. Naval Air Station, Pasco, WA, 1945*
4. *Outlying Fields, NAS Location Map, Pasco, WA, 1945*
5. *Colonel F.T. Matthais Diary, 1942-45*

PASCO NAVAL AIR STATION & OUTLYING AIRFIELDS

US Army Corps of Engineers
Ordnance & Explosive Waste Records Search
Hanford, Washington

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FIGURE 4

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519th AAA Gun Battalion (120mm)
501st AAA Operations Detachment
12th Solid Rocket Maintenance Unit (SRMU)
13th SRMU
16th SRMU

According to the 5th AAA Group Command Report (1950), the Group was reactivated at Fort Bliss, Texas. The 5th AAA Group was moved to Fort Lewis, Washington, in November 1949. The 5th AAA Group was moved to the Hanford Site during March and April 1950.

The history of the 5th AAA Group at the Hanford Site includes the period of March 18, 1950 (the date that the subordinate Unit C battery of the 518th AAA Gun Battalion was fully operational and reportedly ready for action) through September 1, 1958. During the 5th AAA Group's tenure at Camp Hanford, the gun battalions included the following units:

- 501st AAA Gun Battalion (activated January 15, 1949, deactivated December 20, 1957)
- 518th AAA Gun Battalion (activated January 15, 1949, deactivated December 20, 1957)
- 519th AAA Gun Battalion (activated January 15, 1949, deactivated December 20, 1957)
- 83rd AAA Gun Battalion (activated June 28, 1950, redesignated the 83rd AAA Missile Battalion on August 1, 1954, deactivated September 1, 1958)
- 770th Gun Battalion, a Washington National Guard unit (assigned to Camp Hanford on July 28, 1951; returned to Fort Lewis on August 17, 1951; assigned to Camp Hanford on September 10, 1951; and returned to reserve status and replaced by the 83rd AAA Gun Battalion, July 1952) (Sawicki, 1991; Command Report, 1952)

As noted, the 83rd AAA Gun Battalion was activated on June 28, 1950 as a 120mm AAA Gun Battalion and was assigned to Camp Hanford in June 1952. In 1954, the 83rd Gun Battalion's 120mm guns were replaced with NIKE surface-to-air missiles. Photo 5 illustrates the general layout of the 83rd AAA Missile Battalion. In 1956 through 1957, the 120mm guns from the 501st, 518th, and 519th AAA Gun Battalions were removed from Camp Hanford and reassigned to National Guard Units (Aradcom Argus, 1958). Trees mark the site of former AAA and Nike Missile Batteries at the Hanford Site. Photos 6, 7, and 8 show what the former Batteries currently look like. According to Mr. Ekenberg, former Army enlisted man, the AAA guns were being decommissioned during his assignment to the North Slope in late 1956 (Personal Communication, December 1993). In September 1958, the Nike missiles were removed from Camp Hanford and the 83rd AAA Missile Battalion was deactivated.

5.1.4 Nike Missile Program (1954-1961)

Nike missile systems were developed after the end of World War II to produce an air defense system with the capability of engaging high speed maneuverable targets at greater ranges than the conventional artillery available at that time (North Slope ERA, 1993). Guided missiles became operational at Hanford in 1954 when combat-ready missiles, Nike Ajax, replaced the conventional antiaircraft gun units (Aradcom Argus, 1958). The 83rd AAA Gun Battalion was reorganized and redesignated as the 83rd AAA Missile Battalion in August 1954 to man the Nike sites (Sawicki, 1991).

Three Nike missile launch sites and three radar control sites (possibly four) were positioned at the North Slope, and a set of launch and radar control sites were positioned at the ALE Reserve (North Slope ERA, 1993 and PAS Report for ALE, 1993) (Figure 5). Representative aerial photographs of the former locations of Nike launch and control sites on the North Slope are presented as Photos 9 and 10. The Nike launch and the radar control sites at the ALE Reserve were installed by 1955.

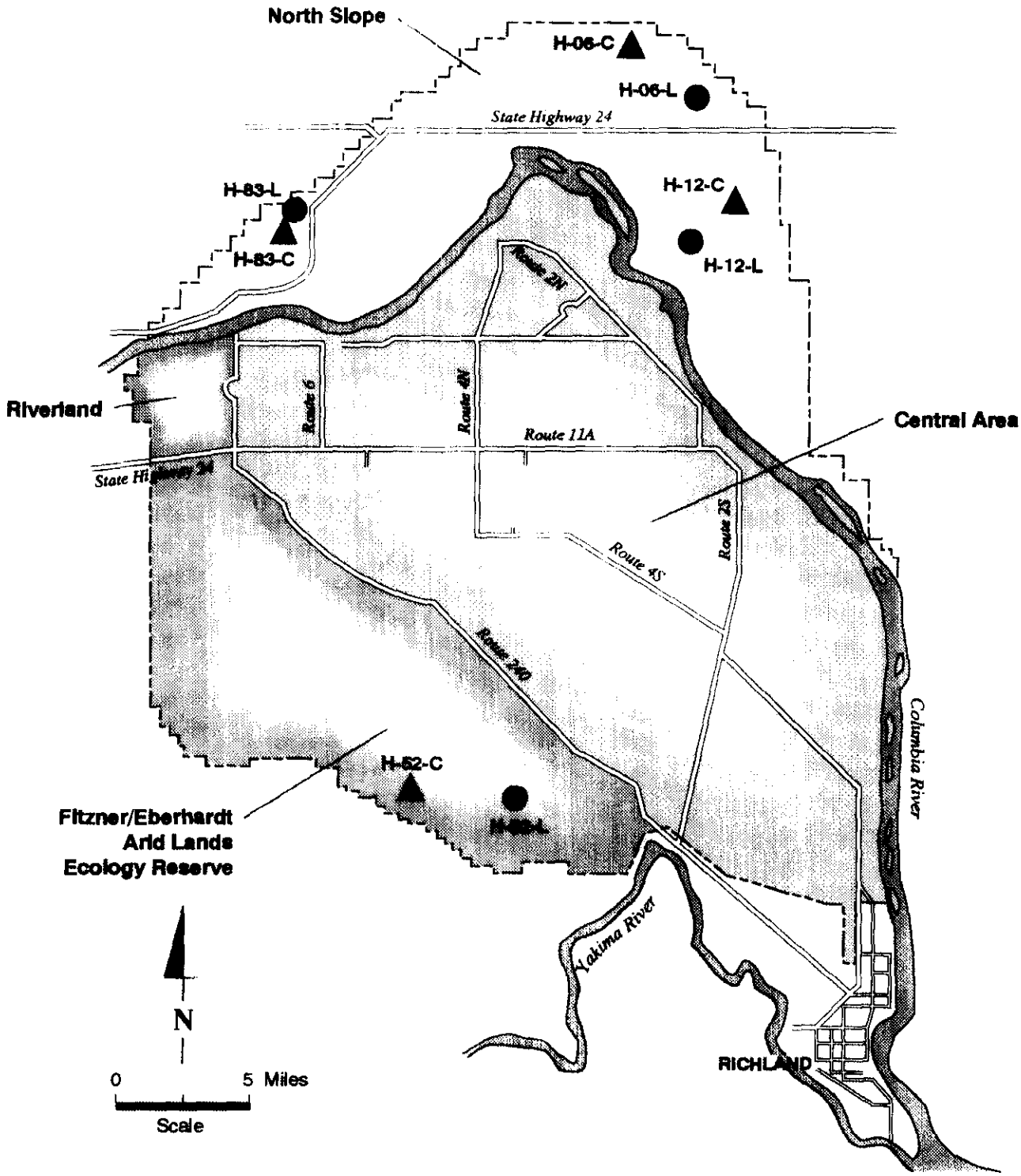
Between 1959 and 1960, position H-06 was upgraded to include Nike Hercules nuclear missiles on the North Slope. The advantage of the Nike Hercules System was its ability to attack high speed, high-flying aircraft formations at greater range with a single nuclear warhead.

The activities at the launch and radar control site on the ALE Reserve were terminated, and disposal of the missiles was conducted in early 1961 (PAS ALE, 1993). Figures 6 and 7 are diagrams of the two missiles stored at Hanford. These Nike launch and radar control sites were new military batteries, and were not formerly occupied by antiaircraft gun units.

According to one report, the Nike missiles were removed from Camp Hanford when the 83rd AAA Missile Battalion was deactivated in September 1958 (Aradcom Argus, 1958). A second source reported that the 52nd Artillery, 1st Missile Battalion, was activated in September 1958 and deactivated in December 1960 (Sawicki 1991). According to another source (J. Eaton, U.S. ACOE), the 83rd AAA Missile Battalion, Batteries A, B, C and D were assigned to the four Nike batteries H-06, H-12, H-52, and H-83 in 1955 and deactivated September 1958. At that time, the 1st Missile Battalion, Batteries A, B, C, and D, were activated September 1958 to the four batteries, until deactivation in December 1958, with the exception of H-06 which was manned by the "A" Battery of the 1st Missile Battalion until December 1960. The Nike battery H-52 located in ALE was preserved. The former launch site of H-52 is used by Battelle/Pacific Northwest Laboratories as their headquarters for wildlife management of the ALE.

5.1.5 Post-Nike Military Activities (1961-1970s)

Military maneuvers occurred over various areas of the Hanford Site after the Nike battalions were deactivated. One documented activity occurred in 1963, which involved a large military maneuver "Operation Braveshield" that took place over a period of several weeks. The maneuver took place in the ALE Reserve. The troops proceeded north to Rattlesnake Springs,



KEY:

- ▲ NIKE Missile Radar Control Site
- ● NIKE Missile Launch Site

SOURCES: *North Slope Expedited Response Action Proposal, 1993*

Preliminary Assessment Screening Report for the Arid Lands Ecology (ALE) Reserve. Hanford, 1993

HANFORD NIKE LAUNCH & RADAR CONTROL SITES

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US Army Corps of Engineers
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Hanford, Washington

FIGURE 5

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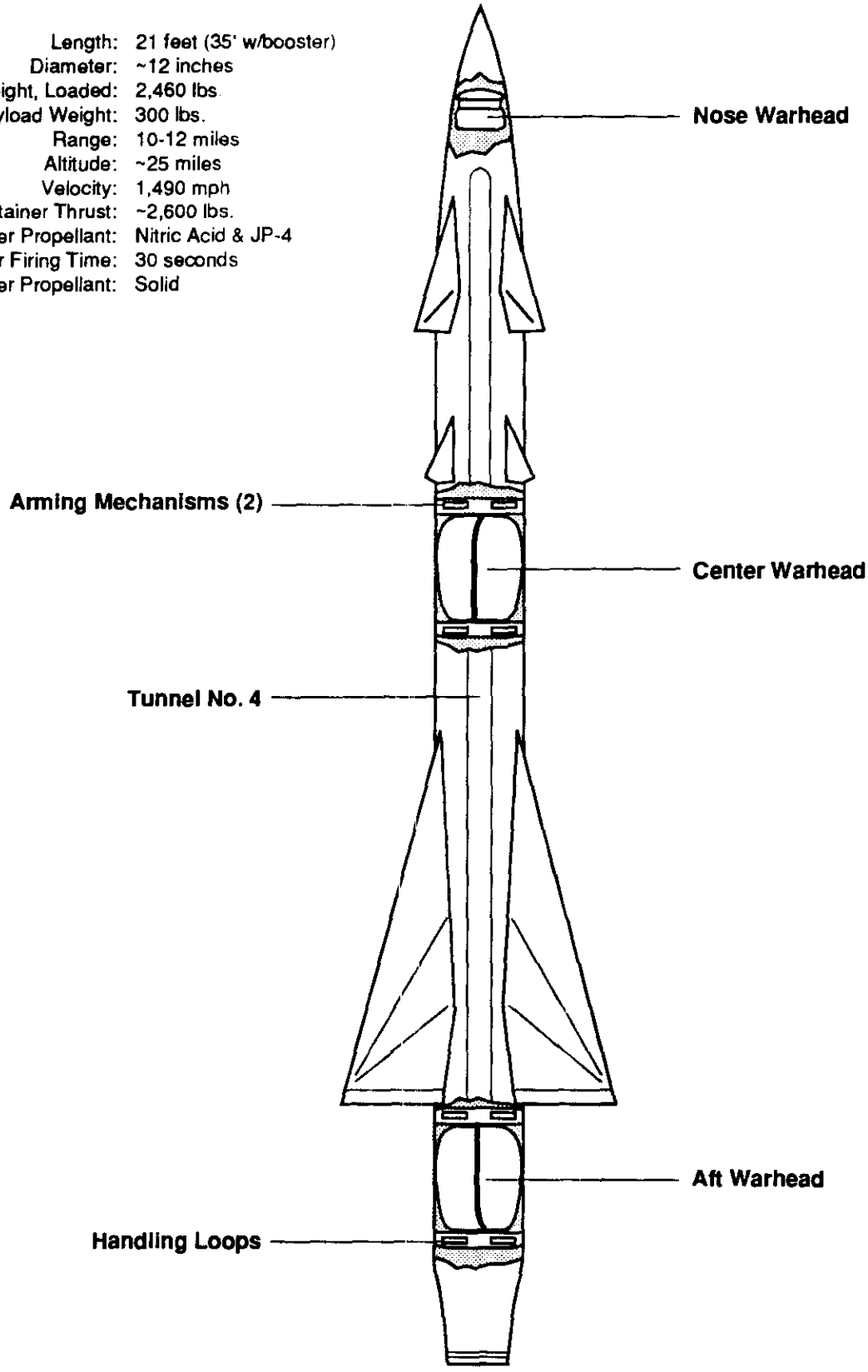
Length:	21 feet (35' w/booster)
Diameter:	~12 inches
Weight, Loaded:	2,460 lbs
Payload Weight:	300 lbs.
Range:	10-12 miles
Altitude:	~25 miles
Velocity:	1,490 mph
Sustainer Thrust:	~2,600 lbs.
Sustainer Propellant:	Nitric Acid & JP-4
Sustainer Firing Time:	30 seconds
Booster Propellant:	Solid



SOURCE:
Environmental Science & Engineering, Inc.
"Historical Overview of the NIKE Missile System," 1984

NIKE AJAX WARHEAD

US Army Corps of Engineers
December 1994 Ordnance & Explosive Waste Records Search
7613-021-005 Hanford, Washington

FIGURE 6

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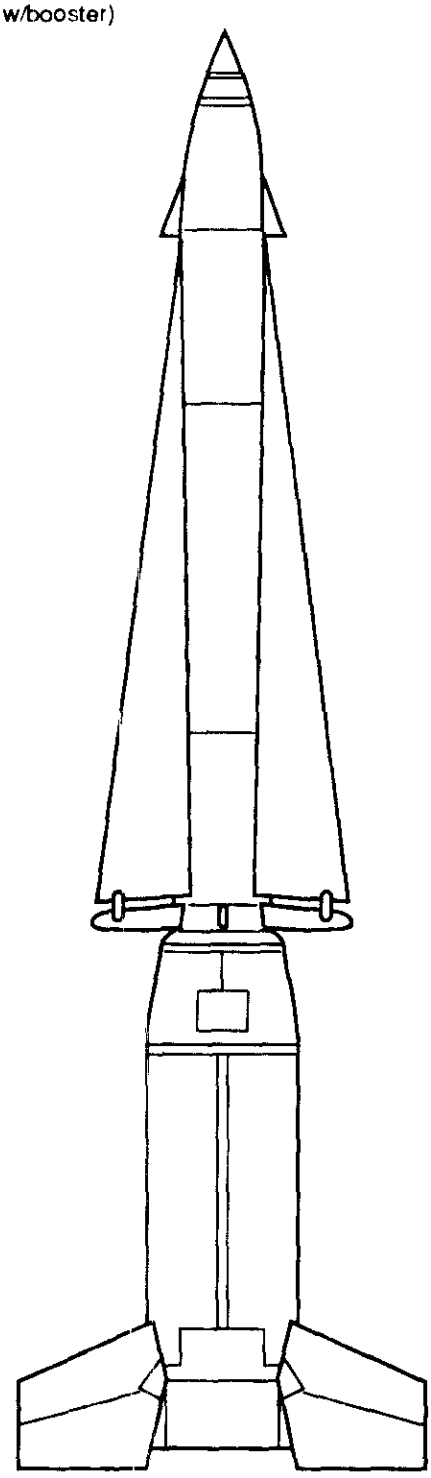
Length:	27 feet (39 w/booster)
Diameter:	31.5 inches
Span:	8.75 feet
Weight, Loaded:	5,000 lbs. (10,400 w/booster)
Payload Weight:	~1,000 lbs.
Range:	75-80 miles
Altitude:	~35 miles
Velocity:	2,200 mph
Sustainer Thrust:	~10,000 lbs.
Sustainer Propellant:	Solid
Booster Propellant:	Solid
Booster Firing Time:	4 seconds



SOURCE:
Environmental Science & Engineering, Inc.
"Historical Overview of the NIKE Missile System," 1984

NIKE HERCULES WARHEAD

US Army Corps of Engineers
December 1994 Ordnance & Explosive Waste Records Search
7613-021-005 Hanford, Washington

FIGURE 7

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then followed the Cold Creek Drainage to the Yakima Firing Range. It is possible that some live small caliber ordnance was used during these maneuvers (ALE, 1993).

5.2 WEAPONS USE AT HANFORD

A variety of weapons were used at Hanford varying from small caliber arms to large caliber antiaircraft artillery. Caliber is a measurement of the bore diameter of a weapon or the diameter of a projectile. The small caliber arms apply to pistols, .30-caliber automatic rifles, and 50-caliber machine guns. The 120mm antiaircraft guns at Hanford are designated as large caliber ordnance. Ordnance is defined as weapons, ammunition, combat vehicles, and miscellaneous military equipment. Other weapons at Hanford included antitank rockets and hand grenades. The following sections describe what types of weapons have been used in the various Hanford areas.

5.2.1 Dupont Patrol and Military Police

Three firing range areas were used by the Hanford Patrol (Figure 8). One firing range used by early Hanford Site security forces (Dupont Patrol) was located in the southeast end of the North Slope, on the east side of the Columbia River bank. It was also reported that 55-gallon drums were present with holes made from 30- and 50-caliber small arms and 37-mm ordnance. A nearby trench contained metal boxes for 50-caliber rounds, 50-caliber brass, links from 50-caliber machine gun belts, and packing tubes for 37-mm rounds. Spent ammunition slugs were also found. Photographs 11, 12, and 13 show views of the North Slope with ruts in the road made by Army vehicles heading to the range, and indications of 50-caliber slugs in a sand bank. Personnel from the Army, 53rd Ordnance Detachment, and the Hanford Site Patrol inspected this area in 1989. No surface or subsurface ordnance and explosive waste or unexploded ordnance were located (North Slope ERA, 1993).

A second firing range that is still under the control of the Hanford Patrol-Hanford security force is located west of the 300 Area. This area is located west of North Richland and has been used as a small arms and machine gun range. The land (over 600 acres) was originally acquired in 1953 for use by the Army until 1961, and continues to be used by the Hanford Patrol for training (U.S. ACOE, 1986).

A third firing range area was on the east end of Gable Mountain and included four separate firing ranges for different purposes. All four firing ranges faced the foot of Gable Mountain and were used to train patrolmen. The four ranges included: an Army Type "L" Pistol Range, a Thompson Submachine Gun Range, a "Walk and Draw" Pistol Range, and an FBI Killer Course Range (Gerber, 1993). Practice with tear gas grenades has also carried out at this range.

5.2.2 Naval Air Station Weapons Use

It is likely that small arms firing ranges were located at many AAA battery sites. Field evidence of such activity was observed at three AAA batteries. Refer to Section 5.5.1.3 for details.

According to reports by Colonel Matthias, weapons were carried on naval aircraft from NAS Pasco. The weapons carried on the aircraft consisted of .50 caliber or smaller. Weapon training activities were not permitted in the air space above the Hanford Site (Matthias 1942-1945).

5.2.3 Antiaircraft Artillery Installation

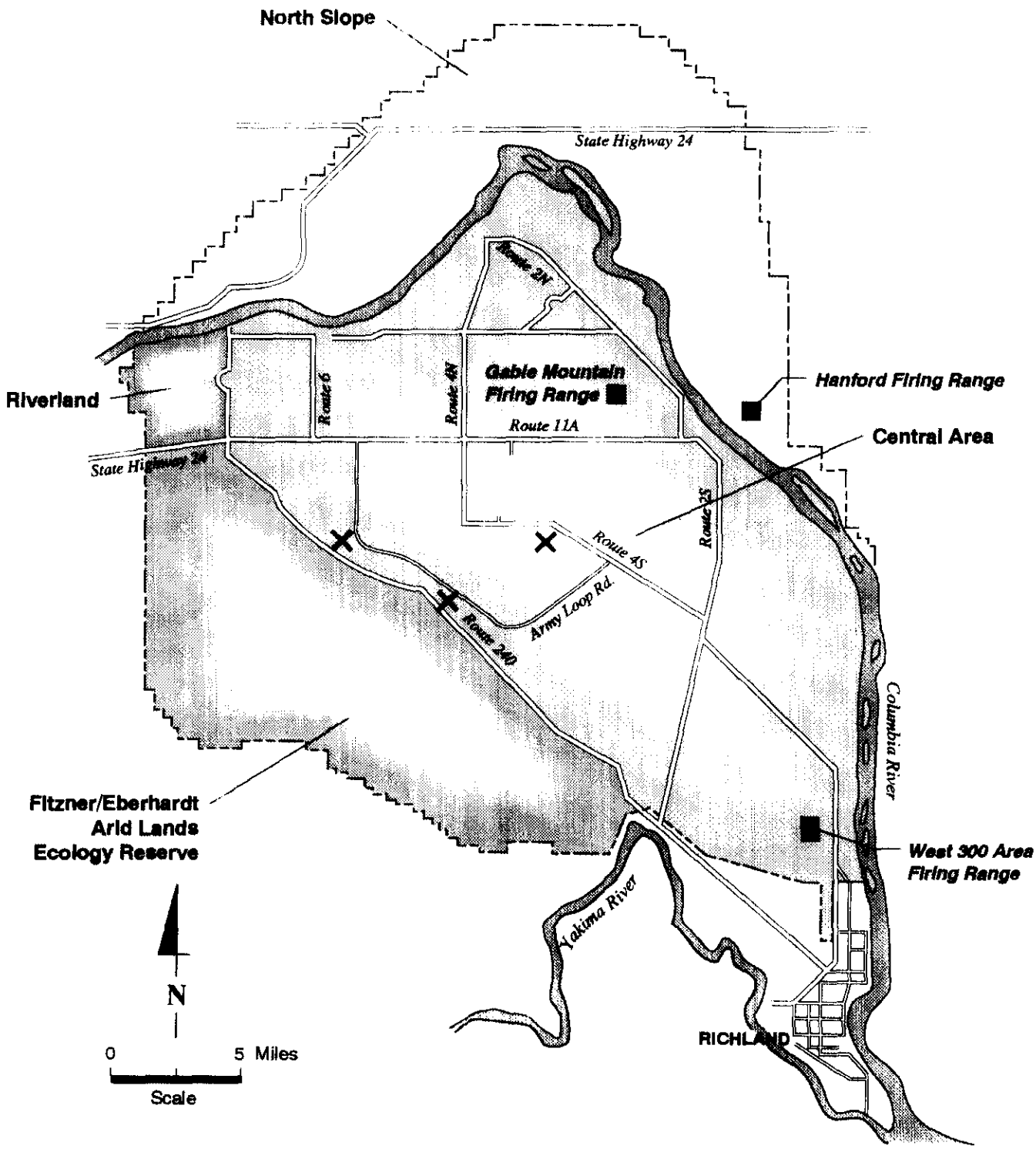
The Army maintained an active antiaircraft artillery group at the Hanford Site during the period 1950 through 1958. As part of its arsenal, the 5th AAA Group maintained up to 64 - 120mm antiaircraft guns, 64 - .50-caliber machine guns, .30-caliber machine guns, antitank rockets (also known as "bazookas"), hand grenades, and small arms such as pistols and rifles (Command Reports, 1950-1952). In 1954, the AAA guns were supplemented with Nike surface-to-air missiles. According to a former Army enlisted man on assignment from 1950 to 1952, there were 16 - .50-caliber machine guns (four at each 120mm AAA gun) assigned to the 501st AAA Gun Battalion at Battery C (Interview, Mr. Turner). A typical antiaircraft artillery battery site is illustrated on Figure 9.

Command Reports (e.g., 5th AAA Group, 1952) identified types of munitions and weapons that would be stored at an individual battery location. In the 1952 Command Report, D Battery of the 519th AAA Gun Battalion was directed to have on hand:

2 - M55 .50-caliber machine guns
1 - M1918A2 .30-caliber Browning automatic rifle
1 - M1918 .30-caliber Browning automatic rifle
8 - M2 .50-caliber machine guns
4 - M20 3.5-inch rocket launchers
20 - Rockets, high explosive, anti-tank (3.5 inch)
12 - Hand grenades
5,040 - rounds of .50-caliber ammunition, 4 ball, 1 tracer
6 - 120mm rounds with VT fuses

5.2.3.1 .50-Caliber Machine Guns

The Command Reports (1950-1952) note that two different models of .50-caliber machine guns were assigned to the battalions at Camp Hanford, and that ball and tracer .50-caliber ammunition was stored in the battalion areas. The M2 machine gun was a single-barrel gun, usually mounted on a vehicle for mobility (Hogg, 1977). The M55 machine gun consisted of four M2 guns mounted on a one-ton, two-wheel trailer (Foss, 1981). The M55 was also known



KEY:

- ■ Firing Range Location
- ✕ Small Arms Shooting Range Location (As per personal communication with J. Maas, 1994)

SOURCES. *North Slope ERA Proposal, October 1993*

Manhattan Project Buildings & Facilities at the Hanford Site, September, 1993

HANFORD FIRING RANGES

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FIGURE 8

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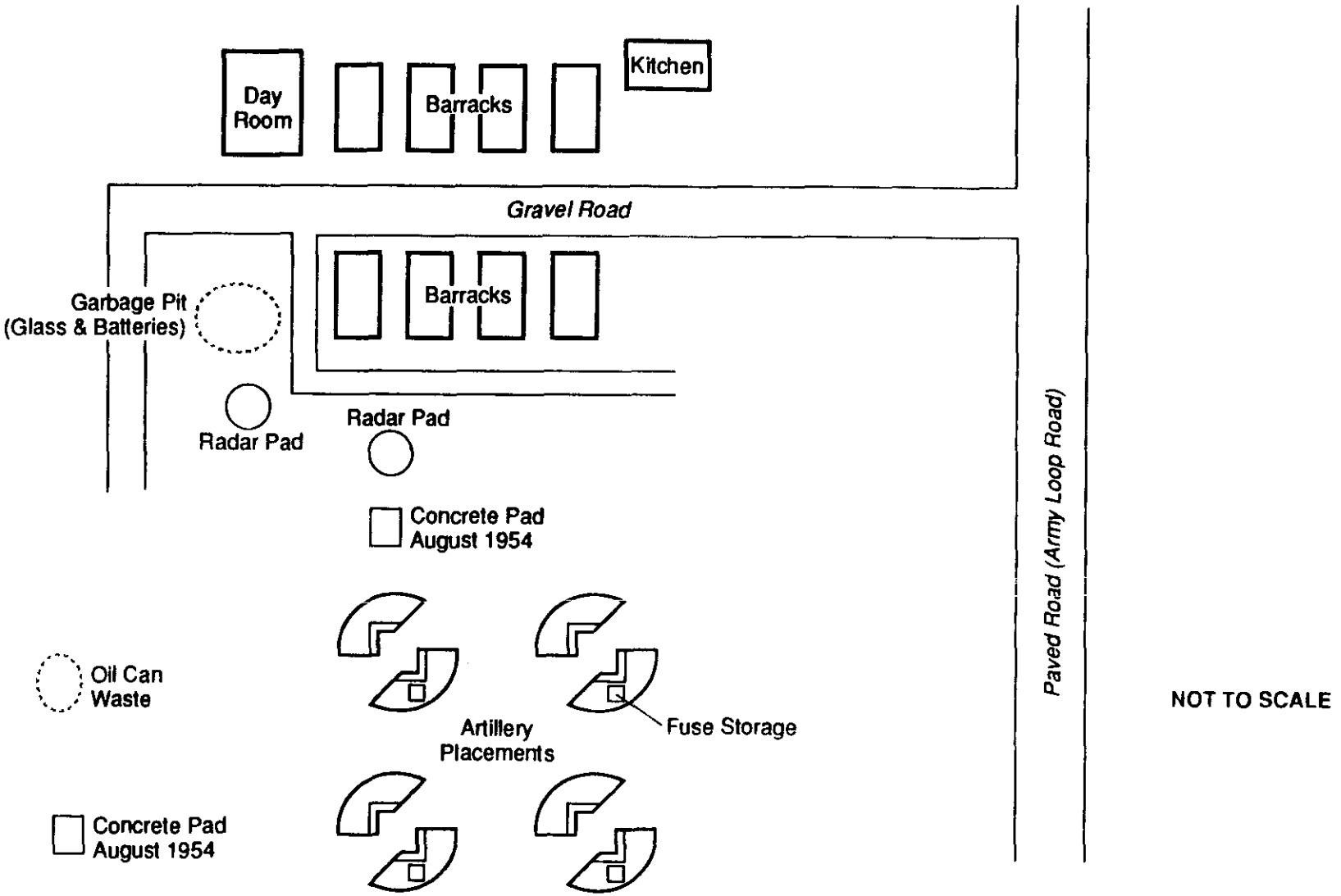

TYPICAL ANTIAIRCRAFT ARTILLERY BATTERY SITE

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FIGURE 9

SOURCE: From sketch drawn by Roger Carpenter, Engineer, Westinghouse Hanford, 1993

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as a "quad-fifty" because of its four barrel arrangement. The M2 machine gun could fire at a rate up to 550 rounds per minute. When the M2 was mounted in the M55 configuration, the four guns would fire cyclicly at a rate of up to 550 rounds per minute per barrel. With an effective range of nearly 5,000 feet horizontal and 3,300 feet vertical, the M55 was considered an effective antiaircraft gun against low-flying aircraft (Foss, 1977). However, in 1955, the Army dropped the "quad-fifty" from its antiaircraft arsenal in favor of a dual 40mm gun (Werrell, 1988). No record of the 40mm guns being deployed to Camp Hanford was noted.

Earlier models of the M55 machine gun had attached ammunition boxes that contained 200 rounds of ammunition per barrel and later models replaced the boxes with ammunition trays (Foss, 1981). Ammunition types included ball, tracer, armor-piercing (AP), and armor-piercing incendiary (API). With a muzzle velocity of 3,000 feet per second, the API ammunition could penetrate ¾-inch armor (20mm) at a range of 1,650 feet (Foss, 1977). References to AP or API ammunition storage at Camp Hanford were not noted, however. According to Command Reports (1950-1952), only ball and tracer .50-caliber ammunition was stored in the battalion areas. Ball and tracer ammunition was combined so that every fifth round of ammunition fired was a tracer round (i.e., 4 ball, 1 tracer). Ball ammunition had a muzzle velocity of 2,500 feet per second (Foss, 1977).

5.2.3.2 .30-Caliber Browning Automatic Rifles

Each gun battery at Camp Hanford was issued two .30-caliber Browning Automatic Rifles (BAR). Each gun battery at Camp Hanford was also issued two similar .30-caliber Browning Automatic Rifles (BAR A2). Figure 10 illustrates the typical Browning Rifles used at the gun batteries. Records note that the Browning Automatic Rifles were Models M1918 and M1918A2. The M1918 was the original model and with minor modifications became the M1918A2 model. The original model was produced from 1917 to 1918 and issued in late 1918. The M1918A2 model was issued in about 1940 (Johnson, 1944). Firing a .30-caliber, 172-grain bullet, the BAR had a muzzle velocity of 2,800 feet per second, and a maximum range of 16,500 feet. Although the BAR had a maximum firing rate of 550 rounds per minute, the average rate of fire was about 100 rounds per minute, because it was limited by its 20 round magazine capacity. The M1918 could fire in a semi-automatic mode, but the A2 could fire only in a fully-automatic mode. Enlisted men at Hanford battalions were ordered to carry their assigned 30 rounds of ammunition with their carbine .30-caliber rifle at all times (Interview, Mr. Turner).

5.2.3.3 105mm Guns

Discarded and empty 105mm cartons were found on the east side of the Riverland area (Photos 14 and 15). However, based on the 1952 Command Report, 105 mm rounds were not listed to be on hand at the various batteries. Evidence to support why the discarded 105mm containers were there was not found during this study. It is possible the containers are remnants from bivouac activities conducted in the 1960s such as "Operation Brave Shield", which was a large military practice maneuver that took place on ALE.

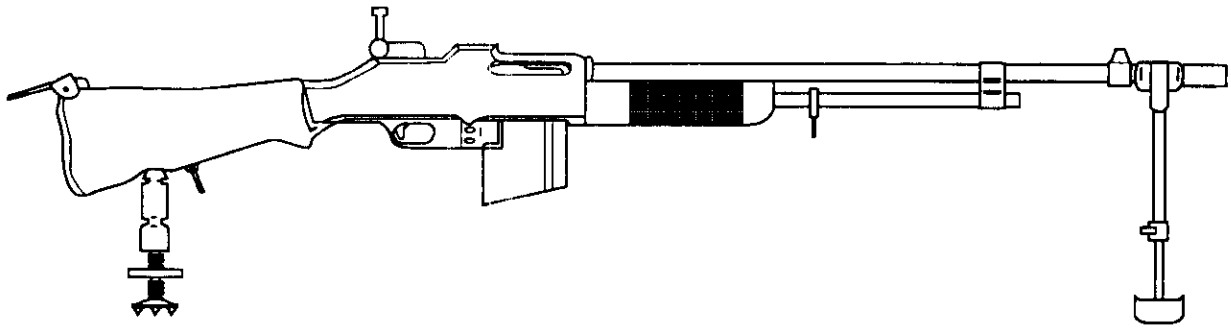
5.2.3.4 120mm Antiaircraft Guns

Each battery was assigned four 120mm antiaircraft guns. Thus, at its peak mission level, the 5th AAA Group had a total of 64 120mm guns assigned to Camp Hanford. With all 16 batteries assigned and active, the 5th AAA Group provided a circle of antiaircraft protection around the critical reactors of Hanford (Command Reports, 1950-1952).

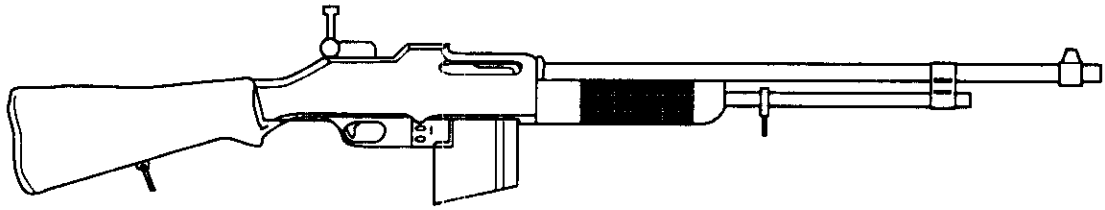
Best available records indicate that the 501st and 518th AAA Gun Battalions were assigned south and west of the Columbia River, while the 519th and the 83rd AAA Gun Battalions were assigned north and east of the Columbia River (Figure 11). There was one exception: "D" Battery of the 83rd Gun Battalion was assigned south of the Columbia River near the western Hanford Site boundary. Each of the battalions noted above consisted of four batteries: A, B, C, and D. Therefore, there were 16 batteries assigned to 16 different locations throughout the Hanford Site (Figure 11). Base Camp 130 (BC 130) and the D Battery of the 83rd AAA Gun Battalion, both immediately south of the Columbia River were abandoned by 1954, possibly because they were subject to periodic flooding by the river (J. Maas, Personal Communication). No evidence or record of AAA gun emplacements were found for BC 130, BC 210, or at the World War II position identified in the Central Area. However, munitions were present based on packaging remnants identified in previous studies (J. Maas, Personal Communication). The numbering system used for the batteries from 1952 through 1959 is listed in Table 1. Shrapnel consisting of iron fragments and aluminum or magnesium fuse ring pieces, was found on the North Slope near the north bank of the Columbia River (Figure 12). Commonly used AAA position numbers used at the Hanford Site, and their relative location to the Nike Missile sites are indicated on Figure 12.

The 120mm antiaircraft gun was originally developed during World War II (Figure 13). According to Johnson (1975), the 120mm gun was designed to supplement the capabilities of the 90mm AAA gun and to provide an effective defense against German high-altitude heavy bombers. Unlike the 90mm AAA gun, the 120mm gun proved to be too heavy, too powerful, and too difficult to mobilize for significant overseas deployment (Hogg, 1974). As a semi-permanent air defense weapon, the 120mm was used for protection of U.S. cities and key installations (Aradcom Argus, 1958).

The 120mm gun (Figure 13) fired a 50-pound projectile (Hogg, 1974) with a maximum vertical range of approximately 47,000 feet and a horizontal range of 81,000 feet (Hogg, 1974, Johnson, 1975) with a muzzle velocity between 2,900 feet per second (fps) and 3,100 fps (Command Reports, 1950-1952; Johnson, 1975). With a well-trained crew, the 120mm gun could be emplaced in 25 to 40 minutes, fire 12 rounds per minute, and provide effective fire against a target for 35 to 40 seconds (Hogg, 1974, Johnson, 1975, Cunningham, 1950). Originally, the 120mm projectile was fuzed with an MT fuse which was later replaced with a VT fuse (Cunningham, 1950). The fuzes basically performed the same function: detonate the projectile at a predetermined altitude (timed) or upon impact with a target.



Browning Automatic Rifle M1918A2-BAR A2 (U.S.), Cal. .30



Browning Automatic Rifle M1918-BAR (U.S.), Cal. .30

Type of Caliber:	30-06
Weight, Empty:	19 pounds (16 pounds M1918)
Length:	48 inches
Magazine Capacity:	20 rounds
Rates of Fire:	550 & 350 rpm
Single Shots:	by quick release of trigger
Effective Combat Range:	1200-1400 yards

SOURCES: *Rifles & Machine Guns, 1944*

Basic Field Manual, Browning Machine Gun, 1940

SMALL ARMS USED AT HANFORD

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FIGURE 10

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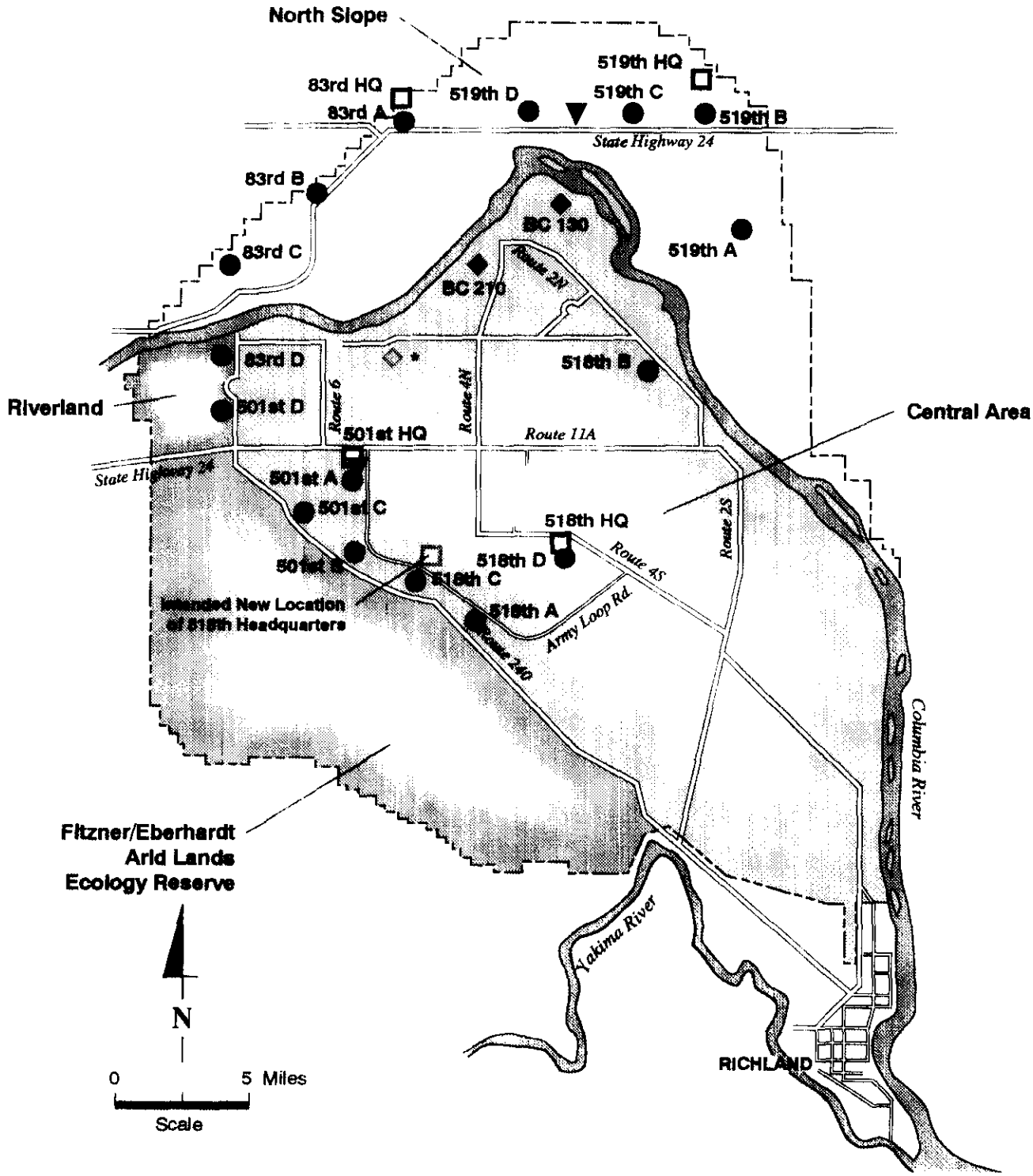

KEY:

519th D	●	519th Antiaircraft Artillery Battalion Battery D
	▼	Former Ammunition Storage Site
519th HQ	□	Battalion Headquarters
BC 210	◆	Base Camp/Site Lacking Gun Emplacements

* *Symbol represents possible WWII AAA Battery, as per personal communication with J. Maas, 1993*

SOURCES: *U.S. Army Command Reports, 1952*
U.S. Department of the Army, 1956
U.S. Army Corps of Engineers, Basic Information, General Site Map, 1958

HANFORD ANTIAIRCRAFT BATTERY SITES

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FIGURE 11

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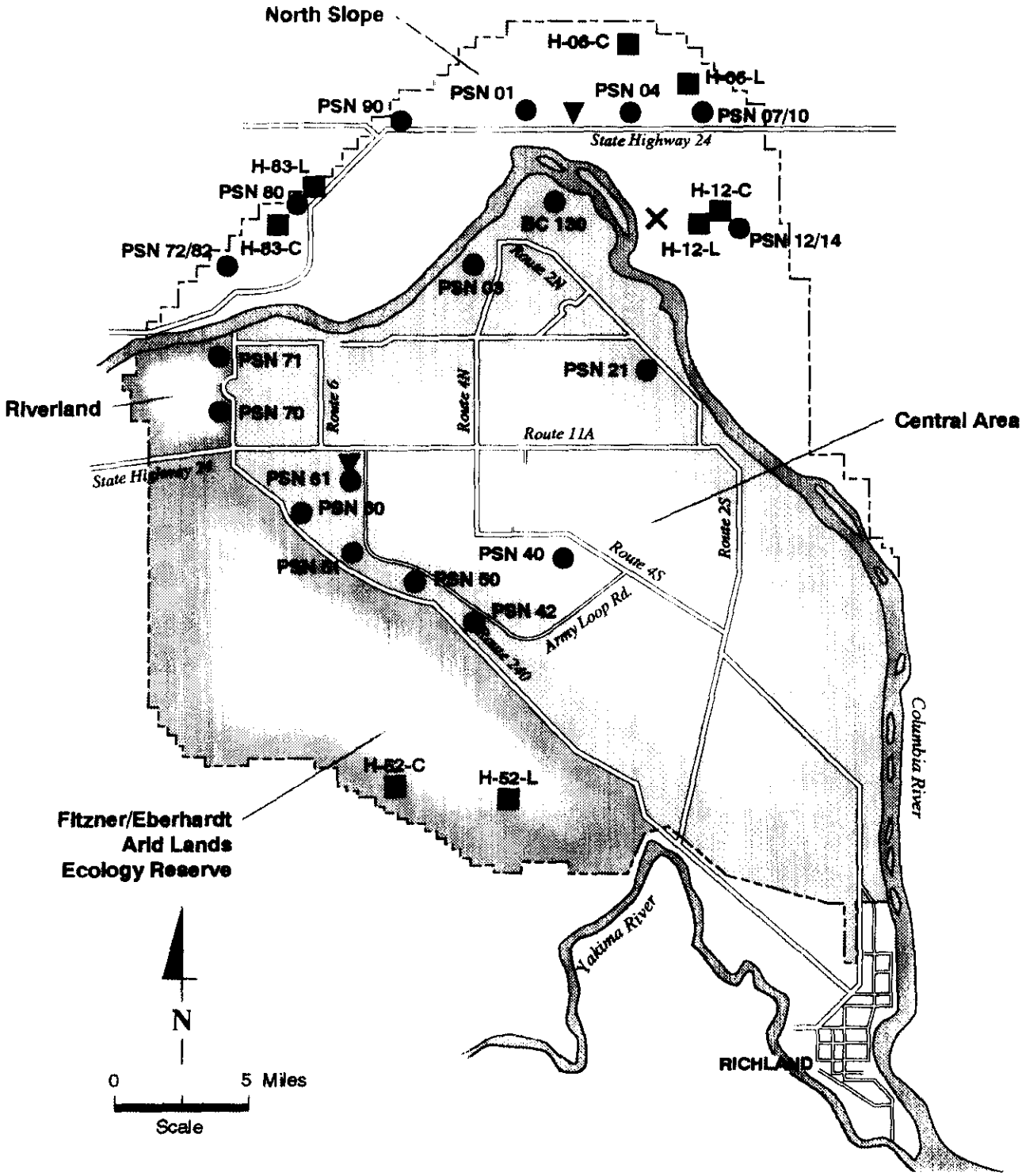

KEY:

PSN 01 ●	Antiaircraft Artillery Battery
▼	Former Ammunition Storage Site
H-52-L ■	Nike Missile Sites
✕	Shrapnel Area

SOURCES:
U.S. Army Command Reports, 1952
U.S. DOE North Slope ERA Proposal, 1993
U.S. Army Corps of Engineers, Basic Information, General Site Map, 1952, 1958
J. Maas. Camp Hanford Forward Positions, 1993

COMMONLY USED AAA & NIKE POSITION NUMBERS

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FIGURE 12

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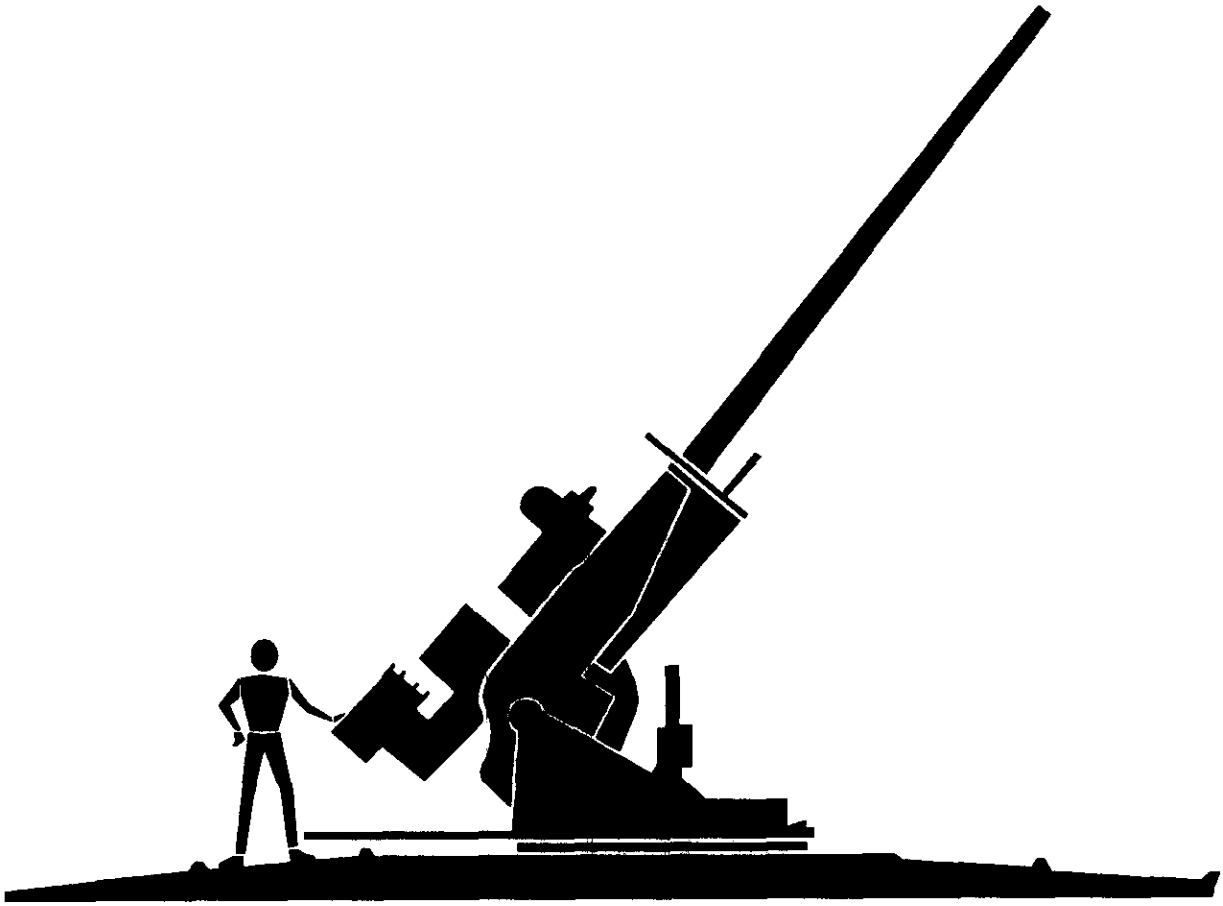

US 120-mm AA Gun M-1

Calibre:	120 mm
Elevation:	-5 to +80 degrees
Traverse:	360 degrees continuous
Weight:	21.8 tons
Muzzle Velocity:	3,100 feet-per-second
Rate of Fire:	12 rounds-per-minute
Time to Emplace:	40 minutes

SOURCE: *Johnson, Curt, 1975, Artillery*
Octopus Books Limited, London, England

TYPICAL 120mm ANTIAIRCRAFT GUN

December 1994
7613-021-005

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Hanford, Washington

FIGURE 13

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Shrapnel from 120mm antiaircraft projectiles consisted of iron fragments and aluminum or magnesium fuse ring pieces. Shrapnel has been found on the North Slope west of the 519th Battery A (Figure 12). The area was investigated during the North Slope ERA study and no surface or subsurface OEW or UXO was found (North Slope ERA 1993).

In addition, two central ammunition storage areas, sometimes referred to as "igloos" were located at the Hanford Site when the 5th AAA Group was activated at Hanford. One storage area with two igloos side by side was located on the North Slope between the 519th D and 519th C Batteries. The second storage area had two separate igloo clusters. One set of four igloos was located north of the 501st A Battery, and the second set of seven igloo clusters was located south of 501st A Battery.

Several interviews conducted during the archive search noted the possible presence of a buried Army vehicle loaded with ordnance. According to Mr. Richard Roos, Westinghouse, several attempts were made to identify the possible location of this "cache," but were unsuccessful. During the archive search, a possible explanation for the source of this particular story was noted: in the Command Report for the 518th AAA Gun Battalion (1950), several photographs were noted in which the battalion was "dug in" for a firing training session at YFC. In three of the photographs, battalion equipment, including a truck and trailers, were parked in excavated trenches and either sandbagged or covered with tarps (the quality of the photographs prohibited presenting them in this report).

Each AAA battery also had a dud pit near the gun where duds could be placed until an appropriate time for disposal. Hanford personnel (Perro, Personnel Communication) reports that inspection of former AAA installations has not revealed evidence that duds were not removed. Perro also stated that considering the low rate of firing, it would be unlikely that dud rounds would occur and end up in the dud pit.

Upon deactivation of the AAA Battalions and the NIKE missile battalion in 1958, the Army and the Atomic Energy Commission (AEC) agreed on the disposition of the former gun and missile emplacements. Several reports (written and verbal) were reviewed indicating that the Army attempted to clean up the battalion areas for eventual AEC takeover. Apparently, the Army did eventually complete the property clean-up and returned control of the sites to the AEC. According to the former AEC Director of Security (F. J. McHale, 1952-1972), the Army left Hanford in "better condition than they got it."

5.2.4 Nike Missile Program

Nike missiles were not fired at the Hanford Site. Nike missiles were only fired at military testing stations (Interview, Cornell). However, evidence of small caliber ordnance have been found near a Nike site. A small pit containing several hundred rounds of fired 30-06 caliber blank ammunition and links for belt-fed automatic weapons were identified near the former Nike radar control site H-83-C (North Slope ERA, 1993). Based on these findings small arms were likely used at the Nike locations. Photographs 16 through 24 illustrate the general

layout of a Nike missile site. These photos illustrate fueling areas, a bunker, a tunnel between bunkers, a missile assembly building, and a landfill area identified at or near H-52-L on ALE during previous investigations. As illustrated in photographs 16 through 24, structures at H-52-L were extensively modified by the AEC for use as nuclear fallout shelters in the event of nuclear war.

The Nike Ajax system (Figure 6) used liquid fuel which was highly toxic and had to be handled with extreme care. The Nike Hercules missiles (Figure 7) primarily used solid fuel which simplified the fueling and maintenance operations of the missile system. Spills associated with maintenance of the Nike missile systems may have impacted adjacent soils. Assessment of fuel spillage was not within the scope of this study.

5.2.5 Post-Nike Military Activities

The Riverland Expedited Response Action Proposal (1993) identified a munitions cache site and a .50 caliber round belt in the southeast corner of the Riverland area, near Highways 240 and 24. Various military explosives were stored in this munitions cache in the 1970s. The cache's contents were sent to the Yakima Firing Range to be destroyed.

Additional information identified ordnance that was reportedly removed from a ridge overlooking the Columbia River in the east-central portion of Riverland (Interview, Mr. Valcich). This ordnance included a machine gun post, tank tracks, and antiaircraft artillery pieces.

It is also likely that small arms were also used during bivouac activities that were conducted on the ALE Reserve during the post-Nike period.

5.3 WEAPONS PLACEMENT

5.3.1 Antiaircraft Artillery Batteries

According to the Command Reports (1950-1952); A, B, and C Batteries of the 83rd AAA Gun Battalion; the 770th AAA Gun Battalion; and A, B, C, and D Batteries of the 519th AAA Gun Battalion were assigned positions in the North Slope area (Figure 11).

Seven AAA gun batteries were located in the central portion of Hanford (A, B, and C Batteries of the 501st Battalion and A, B, C, and D Batteries of the 518th Battalion). Six of these batteries were located in the lowland areas, on the east side of Highway 240, and one (B Battery of the 518th) was located northeast of Gable Mountain (Figure 11). No information was noted that indicated any of the AAA batteries were assigned positions in the ALE Reserve, which includes the foothills of Rattlesnake Mountain.

Based on the same reports (Command Reports 1950-1952), D Battery of the 83rd and D Battery of the 501st AAA Gun Battalions were located in the Riverland Area. Based on

available information, the two batteries were located near the eastern boundary of the Riverland Area (Figure 11). A typical antiaircraft artillery battery site is illustrated in Figure 9.

5.3.2 Nike Launch Sites

Several maps of the Hanford Site Forward Area dated 1956 and 1958 and DOE reports confirm that there were four Nike missile launch sites and four Nike radar control sites at Hanford (DOE - North Slope ERA, 1993 and DOE - Preliminary Assessment Screening Report for the Arid Lands Ecology Reserve, 1993). Three Nike missile launch sites and three Nike radar control sites were located on the North Slope, and one Nike missile launch site and one Nike radar control site was located in the ALE. Figure 5 illustrates the approximate location of the launch and radar control sites. Figure 14 illustrates the layout of a missile radar control site (H-52-C), and Figure 15 illustrates a missile launch site (H-52-L), both were located in the ALE.

Records indicate that each of the four Nike missile launch sites had two magazines, 20 Ajax missiles, and 8 launchers. Position H-06-L was also equipped with a "universal" launcher, capable of launching Hercules and/or Ajax missiles, and kept 12 Hercules missiles on hand (J. Eaton, Tri-Services Cultural Resources Research Center, USACOE).

5.4 FIRING HISTORY

5.4.1 Hanford Patrol and the Naval Air Station Firing Activities

The Hanford Patrol and military officers reportedly used .30 and .50 caliber and 37mm ammunition. Various pistols and submachine guns were fired at the Gable Mountain shooting ranges noted above. MPs were assigned .45 caliber guns and likely fired these guns at the shooting ranges and in the patrol station areas. Aircraft that flew for the Pasco Naval Air Station reportedly carried .50 caliber or smaller arms but were not permitted to fire over the Hanford Site. However, evidence of metal pieces from bomb remnants were observed in a Naval outlying airfield at Hanford 1-mile west of the 300 Area. No evidence of explosive waste was observed at the former airfield. Details of this outlying airfield are discussed in Section 5.1.2. The COE Huntsville Division has stated that spent small caliber ammunition does not pose a significant OEW hazard.

5.4.2 AAA Batteries

Several entries in the Command Reports (1950-1952) indicated that the 120mm guns were fired at the Hanford Site. According to a former enlisted man assigned to Battery C of the 501st Battalion, the AAA guns were fired once, between 1950 to 1952 (Interview, Mr. Turner). Other entries in the Command Reports (1950-1952) noted that training using the 120mm guns and the .50-caliber machine guns was conducted at the Yakima Firing Center located northwest of the Hanford Site (Figure 3). Entries in the Command Reports did not note whether machine guns were fired at the Hanford Site.

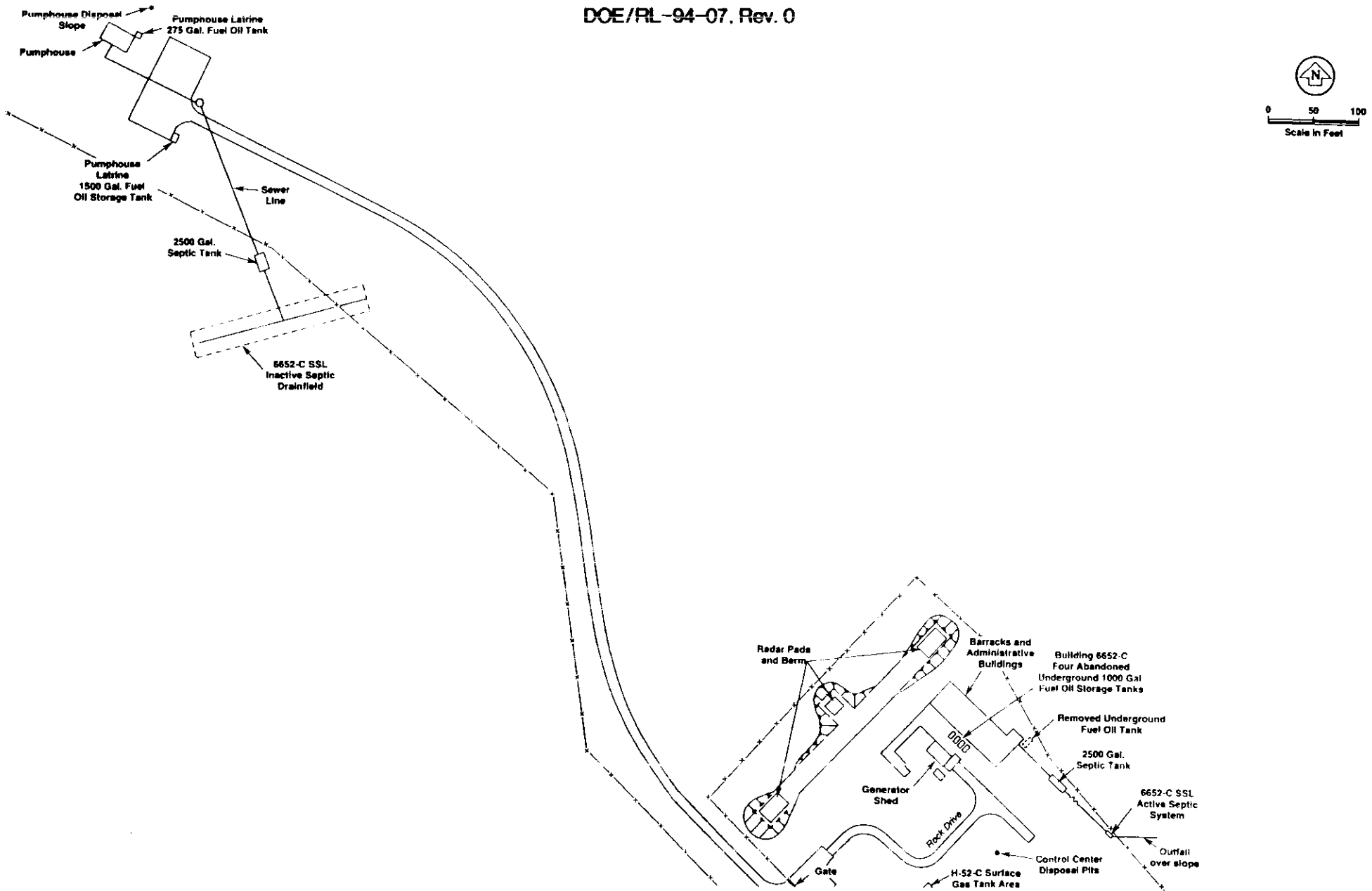
However during this study, Dames & Moore toured a former .50-caliber firing range at the North Slope in December 1993. Numerous spent rounds of .50-caliber ball ammunition were found in the sandy soil. Also, during a Dames & Moore tour of the Riverland Area in December 1993, debris from several empty 105mm containers was found in the southeast section.

During its tenure at Camp Hanford, the 5th AAA Group conducted firing training using the 120mm guns at the YFC. Training was scheduled tri-annually, but actual training took place approximately twice yearly with each of the battalions rotating from active status to training status. Prior to a training session at the YFC, only the guns from one battery of one battalion were moved to the YFC. The other battalions would then "borrow" the training guns during their firing at the YFC. This schedule permitted a sufficient contingent of men and guns to be on alert status at Camp Hanford at all times (Command Reports, 1950-1952).

Upon returning of the guns to Camp Hanford, the owner-battalion would set up the 120mm guns and prepare them for alert duty. As noted in the Command Reports (1950-1952), after transporting the guns and returning them to active status, the owner-battalion often fired a series of rounds at the Hanford Site. These rounds were identified as "settling," "calibration," or "verification" rounds. Based on the entries recorded in the Command Reports, each of these firings included a live projectile for each shot. An informant stationed at Camp Hanford in the early 1950s indicated to J. Maas, U.S. Army Corps of Engineers, Seattle, that the settling rounds were fired without projectiles; however, documentary evidence does not support this. In the 519th AAA Gun Battalion Command Report (1952), one unexploded projectile was reported as a result of settling round firing.

Based on the entries in the Command Reports (1950-1952) of live firing at Hanford, 60 rounds were fired in 1950, 176 rounds were fired in 1951, and 160 rounds were fired in 1952. As noted previously, the AAA guns were present at Hanford until 1957. No Command Report records were available for review for the period of 1953 through 1957. According to a government historian (R.L. Collier, U.S. National Archives and Records Administration, Suitland), individual unit histories were no longer required for permanent archiving after the end of the Korean Conflict in 1953. Since the U.S. was no longer at war, the records were not maintained. Only those unit histories written during war periods have been permanently archived. Therefore, only 396 Hanford Site firings have been documented.

The number of rounds fired at the Hanford Site are likely higher than the documented 396 rounds if additional rounds were fired between 1953 and 1957. This assumes that firing training continued at the YFC during the period from 1953 through 1957 and that the settling, calibration and verification firing at the Hanford Site continued when the guns returned from the YFC. Applying the average annual firing rate documented from 1950 through 1952 (132 rounds/year), 660 rounds may have been fired from 1953 through 1957. Therefore, it is possible that over 1,000 rounds may have been fired from 1950 through 1957.



MISSILE RADAR CONTROL SITE AT ALE RESERVE H-52-L

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FIGURE 14

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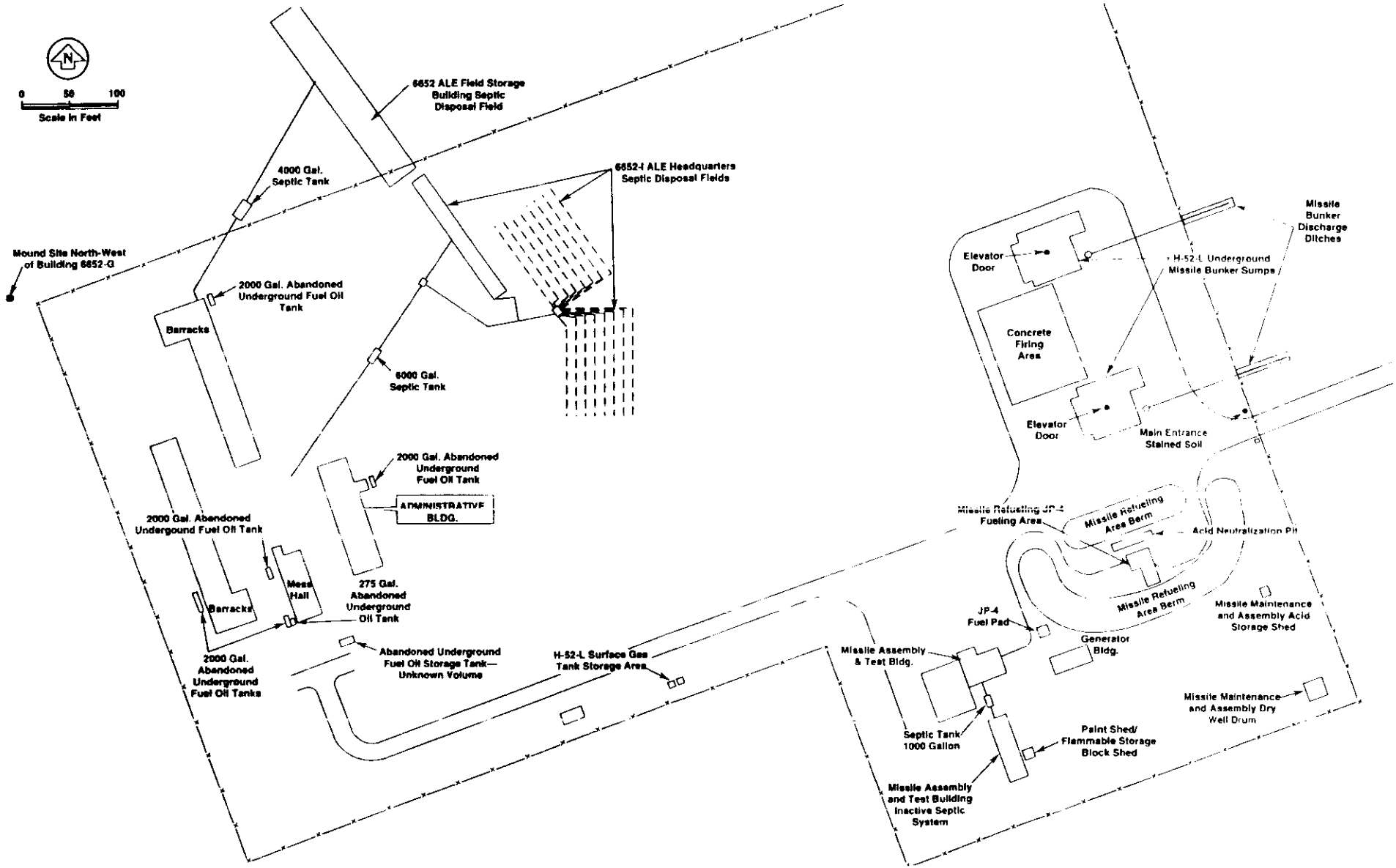

MISSILE LAUNCH SITE AT ALE RESERVE H-52-L

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FIGURE 15

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One unexploded round was reported in the Command Reports (519th, 1952). The round was reported during settling firing in February 1952 by C Battery of the 519th AAA Gun Battalion. According to the Command Report, an attempt was made to locate the round, but was unsuccessful. However, in October 1952, an unexploded round was found by Army personnel and destroyed by Explosive Ordnance Disposal (EOD) personnel. The Command Report documenting this information did not confirm that the found dud was the same round fired in February 1951.

Although only one unexploded round has been documented in the Command Reports, additional unexploded rounds may have been fired during the period from 1953 through 1957 when reports are lacking. Applying the average occurrence of unexploded rounds (one) for the total firing documented from 1950 through 1952 (396 rounds), one can establish a rate for the rounds that might fail to explode (i.e., one failure per 396 rounds). Applying the failure rate and the assumed number of rounds fired during the years 1953 to 1957 (660 rounds), approximately two additional rounds may have failed to explode during the undocumented years of 1953 through 1957.

Based on a review of the information contained in the Command Reports (1950-1952), the officers of the 5th AAA Group appeared to maintain thorough records regarding the amount of ammunition stored and used at Hanford as well as at YFC. Each battalion's Command Reports include entries regarding the number of 120mm rounds fired and dates and locations of firing (Hanford or YFC). Some entries in the Command Reports also include information such as the lot and serial numbers of the 120mm projectiles stored at each battery.

Command Report entries regarding the settling, calibration and verification firing of the guns also include information such as measured and calculated muzzle velocity achieved during calibration firing, range and altitude calculations of the projectile bursts during calibration and verification firing, and detailed safety instructions with respect to procedures for firing the guns at Hanford. For example, in the 5th AAA Group Command Report (1950), a copy of "Training Circular Number 29" was included. Item number four (4) of the document stated "Guns will in every case be fired singly and only after the previous burst has been observed." Such attention to detail in the Command Reports would seem to indicate that the Army was meticulous in its care of ammunition.

5.4.3 Nike Missiles

The Nike Ajax and Nike Hercules missiles were not fired at Hanford.

5.4.4 Post-Nike Era

Small arms were likely used throughout various areas of the Hanford Site. Small caliber ammunition that has been found at Hanford has been taken to the Yakima Firing Center for appropriate disposal. Evidence of small arms and training mines with smoke charges were found in the flat-lying areas of the ALE Reserve below an elevation of 1,200 feet. According to Mr. Rogers, the mines have since been detonated (Interview, Mr. Rogers, December 1993).

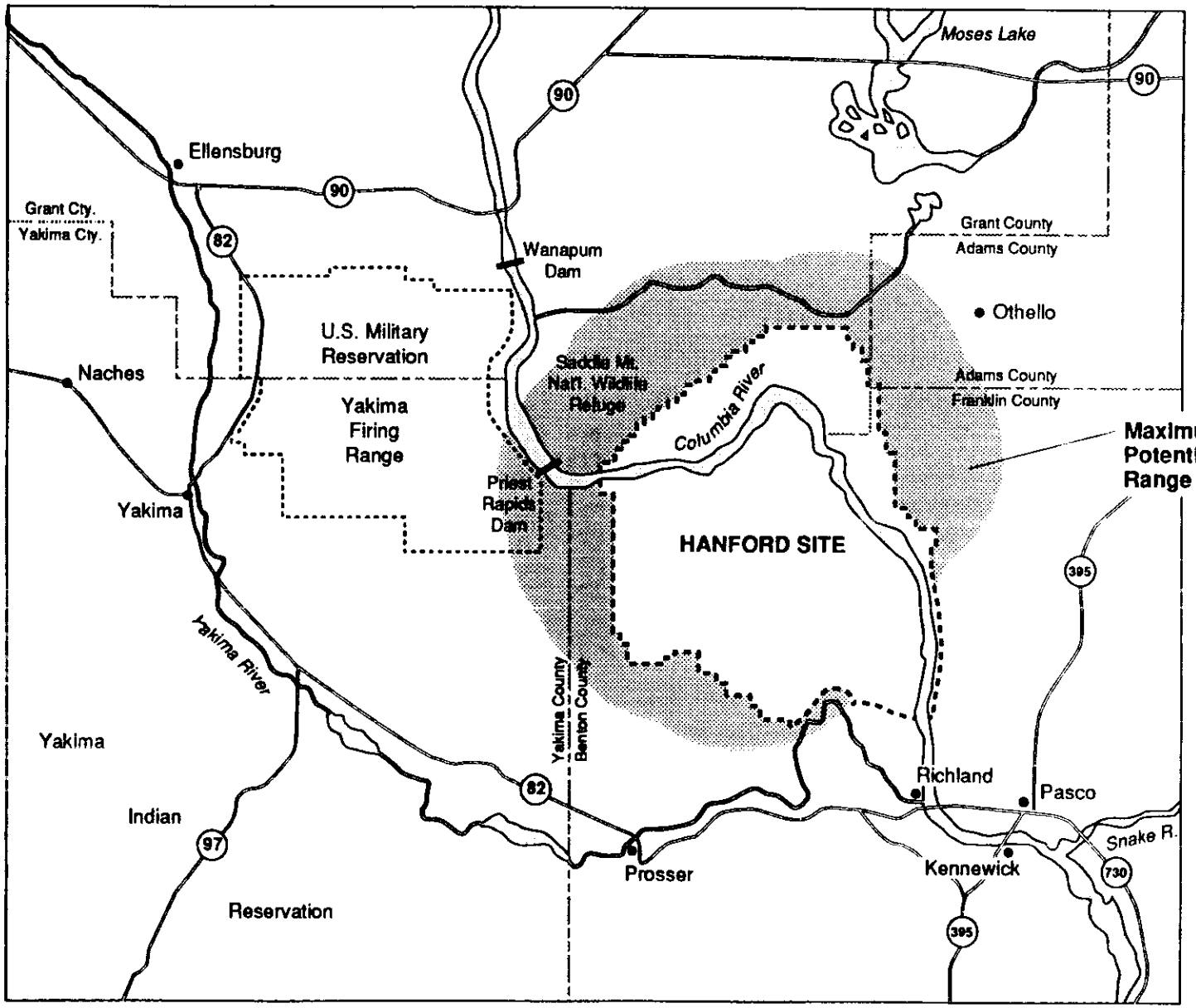
5.5 FIELD OF FIRE AT HANFORD

Although a variety of ordnance were maintained at the Hanford Site, the most significant OEW hazard is related to the ammunition caches and unexploded 120mm rounds. The ammunition caches have been located and identified during previous investigations (North Slope ERA Proposal, 1994; Riverland ERA, 1993; ALE PAS, 1994). Previous investigators have indicated that ammunition caches do not pose significant OEW hazards. The locations of the small arms firing ranges are also generally known and their OEW hazard is limited to spent casings and exploded ordnance fragments. The remaining potential OEW hazard at the Hanford Site is related to the 120mm AAA batteries.

Dames & Moore used information from this study and a ballistics assessment to identify likely field of fire of the 120mm gun batteries (Figure 16). Based on information available from Johnson (1975), Hogg (1974), Cunningham (1950) and the Command Reports of the 5th AAA Group (1950-1952), most-likely scenarios of vertical and horizontal ranges for the 120mm guns were calculated. Although Johnson (1975) stated that the maximum muzzle velocity for the 120mm gun was 3,100 fps; the Command Reports (1950-1952) that contained actual firing data, noted actual muzzle velocities of 2,920 fps. Vertical and horizontal ranges were calculated with variable muzzle velocities for this study because of the apparent variability of muzzle velocities. In addition to variable muzzle velocities, the study of aerodynamics has advanced considerably since the time the 120mm guns were actually used. Factors that are now better understood include: the air turbulence and drag induced by a projectile moving at supersonic speeds, the effects of elevation and air density, and the effects of angle of fire and gravity.

The most-likely horizontal and vertical ranges of the guns fired at Hanford were calculated by solving relatively complex differential equations that combined these various factors. The equations are described in Appendix C.

Trajectories were calculated for a range of initial muzzle velocities and firing angles. According to Johnson (1975), the 120mm gun could be fired at angles varying between -5° to +80° (known as "elevation" of the gun). The maximum range and height of the projectile are given for three selected trajectories in Table 2. As may be noted from the Table 2, the maximum vertical ranges (altitude) were obtained when the gun was fired at a very steep angle (80°), and maximum horizontal ranges (distance) were obtained when the gun was fired at 45°.



NOTE:
The maximum potential range is based on ballistics modelling. No physical evidence of ordnance has been identified beyond the Hanford site.

SOURCE: American Automobile Association, 1992

POTENTIAL 120mm FIELD OF FIRE BEYOND HANFORD SITE

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FIGURE 16

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Assuming a maximum muzzle velocity of 3,100 fps, with a firing elevation of 45°, a 120mm projectile could be expected to travel 59,300 feet from the gun (more than 11 miles). Using a muzzle velocity of 2,950 fps (most-likely muzzle velocity based upon actual firing data as recorded in the Command Reports by the artillery officers), the distance a 120mm projectile traveled is 55,700 feet (10.5 miles).

The 45° firing elevation is the most-likely firing angle used during settling, calibration and verification firing of the guns at Hanford. This assumption was based upon information contained in the Command Reports (1950-1952) made by the artillery officers. The artillery officers recorded muzzle velocity (calculated and measured), altitude and range of artillery bursts, and time-to-burst (after firing) of a projectile. The officers also noted the elevation of firing in "mils." There are 6,400 "mils" in a circle or in 360°. By matching the known information with the calculated values, it was observed that for a projectile to burst at the time and distance noted by the artillery officers, the angle of fire would have been approximately 45°.

Therefore based on actual firing data, if a 120mm round did not detonate in the air, as intended, it is possible that the round traveled 10.5 miles prior to impact. Considering also that a round fired at a 45° angle achieved an altitude of approximately 23,000 feet, it seems unlikely that the Saddle Mountains (2,000 foot elevation) to the north or the Rattlesnake Mountains (2,000 foot elevation) to the west of Hanford would have imposed much of a barrier.

Figures 17, 18, and 19 are graphical representations of selected trajectories of a 120mm projectile fired at varying muzzle velocities. Angles of firing presented are 5° (presumed minimum firing angle) (Figure 17), 45° (presumed actual firing angle) (Figure 18), and 75° (illustrative of a maximum firing angle) (Figure 19). Also presented is a graphical representation of the three firing angles based on a muzzle velocity of 2,950 fps to illustrate the differences in altitude and range of the projectiles based on firing angle (Figure 20).

Because the center of mass of a projectile would not significantly change after detonation, the flight path of the shrapnel would essentially follow the same path predicted for the intact projectile. Thus, the predicted location of shrapnel on the ground is similar to the predicted location of an unexploded projectile. The difference would be the size of the impact zone. That is, the impact zone for shrapnel would be a very large circle around a center point; whereas the impact zone for a projectile would be a comparatively small circle around a center point. The size of the shrapnel impact zone would vary based on the altitude of the detonation and the brisance of the explosive charge in the projectile.

5.5.1 Potential OEW Areas

The potential OEW areas appear to be associated with dud-fired antiaircraft artillery projectiles, and munitions storage.

5.5.1.1 Antiaircraft Artillery Batteries

The Command Reports (1950-1952) from the 5th AAA Group, including Command Reports from the individual Gun Battalions, contained significant information regarding the use and storage of ordnance at Camp Hanford. A few of the Command Reports contained hand sketches of site layouts for the batteries (Figure 9). An interpretation of the various drawings was that each battery was permitted to construct and locate the ammunition storage area in any manner that was functional to the mission. There was no apparent standard procedure for the construction and location of the storage area. For example, one battery had tents for storage, another had partially buried storage tents, and a third battery had completely dug-in and constructed "ammo dumps".

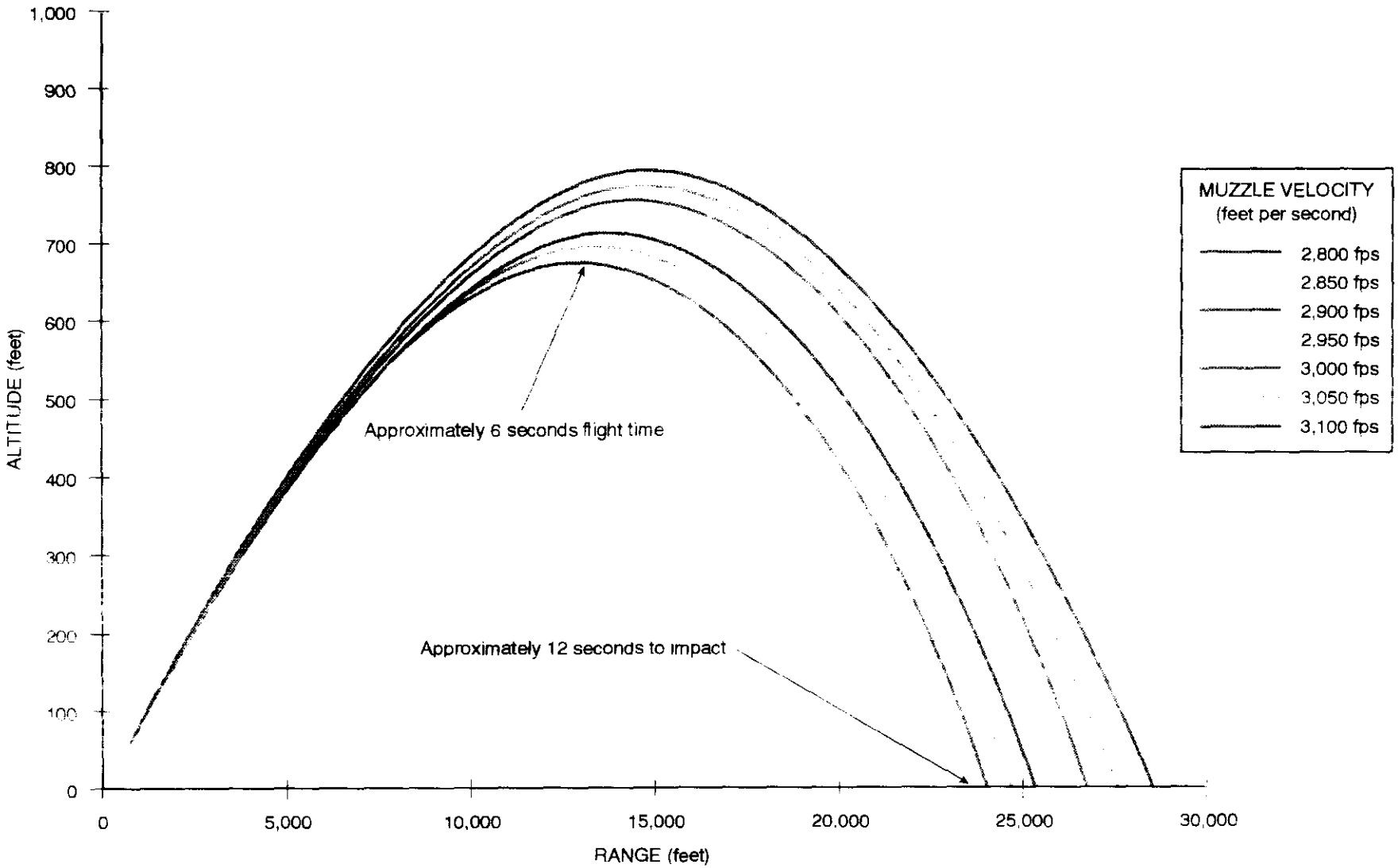
- Each AAA battery had a munitions storage area. These areas could pose OEW hazards if they have not been properly decommissioned.

The Command Reports contained information regarding the particular guns that fired (i.e., which battery fired), the number and types of rounds fired, the dates of firing, and the results of the firing. Often, information was contained in the reports directly from the artillery officer's field notes. Such information included the type of firing (settling, calibration, or verification), the numbers of rounds fired, the altitude and range of the burst (i.e, detonation of the projectile), and information relating to the serial and lot numbers of the projectiles fired.

Based on information contained in the artillery officer's field notes, it was estimated that the angle of firing for the guns was between 35° and 45°. Altitudes and ranges for bursts reported by the artillery officers were typically 12,000 feet high and 24,000 feet down range. Because of the apparent consistency in these values reported from one artillery officer to another, it is reasonable to assume that settling, calibration and verification firing followed a standard procedure.

According to historical records and maps obtained from Westinghouse, there were 16 gun batteries assigned at the Hanford Site. Information contained in the Command Reports indicated that all 16 of these locations fired on-site sometime during 1950-1952.

The likely trajectories and fields of fire were evaluated for each battery to assess potential impacts to the study area. The maximum horizontal range of 10.5 miles was used assuming the 120mm gun was fired at a 45° setting. Also it was assumed that the batteries did not fire over other batteries, research areas (central portion of Hanford Site), Camp Hanford, the Hanford Ferry, and the Midway Substation. The 10.5 mile firing range for the outer most batteries has been plotted (Figure 16) to identify areas of potential OEW beyond the Hanford Site boundary.



POTENTIAL RANGE OF TRAJECTORIES OF 120mm PROJECTILE FIRED AT 5° ELEVATION

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FIGURE 17

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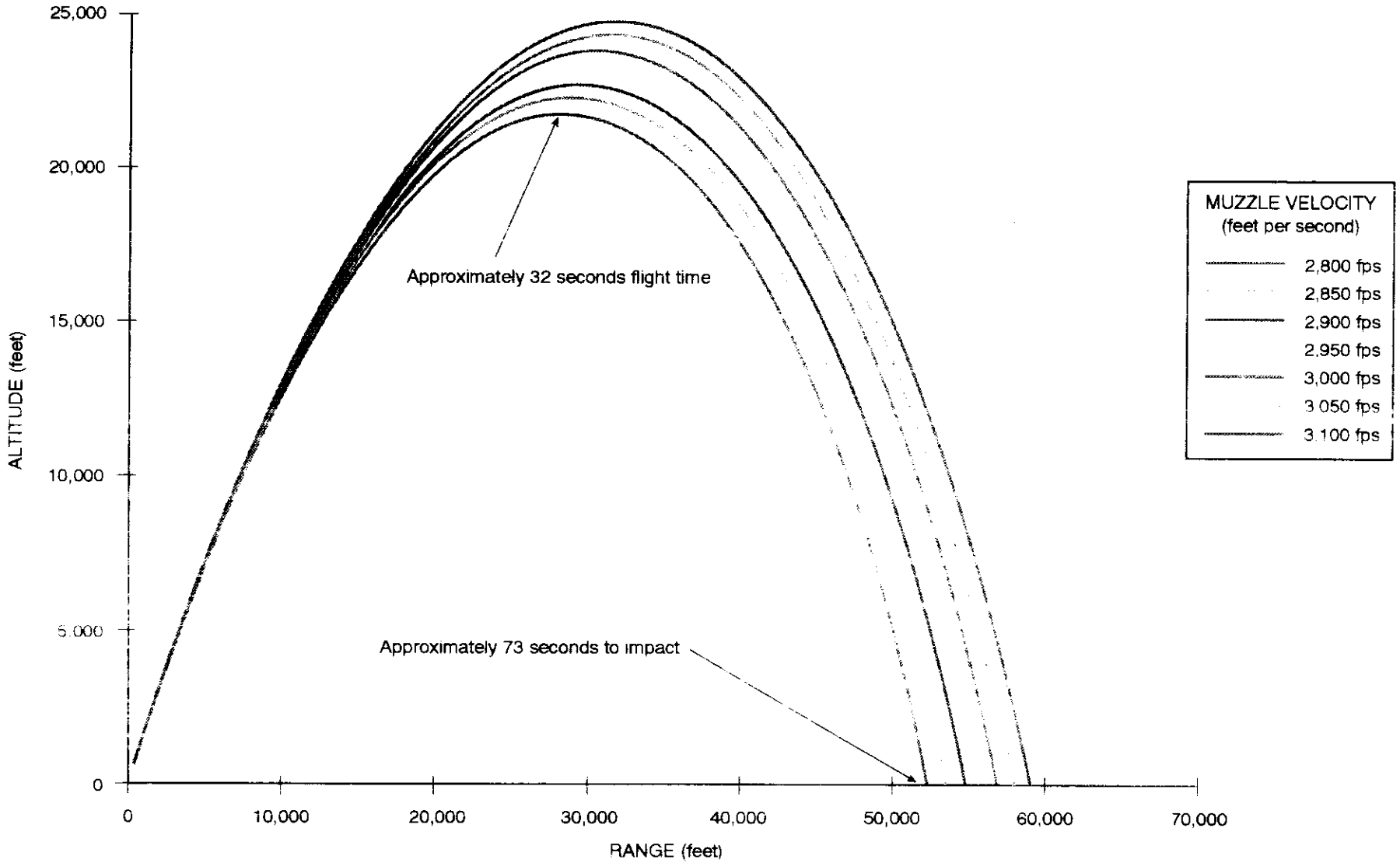

POTENTIAL RANGE OF TRAJECTORIES OF 120mm PROJECTILE FIRED AT 45° ELEVATION

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FIGURE 18

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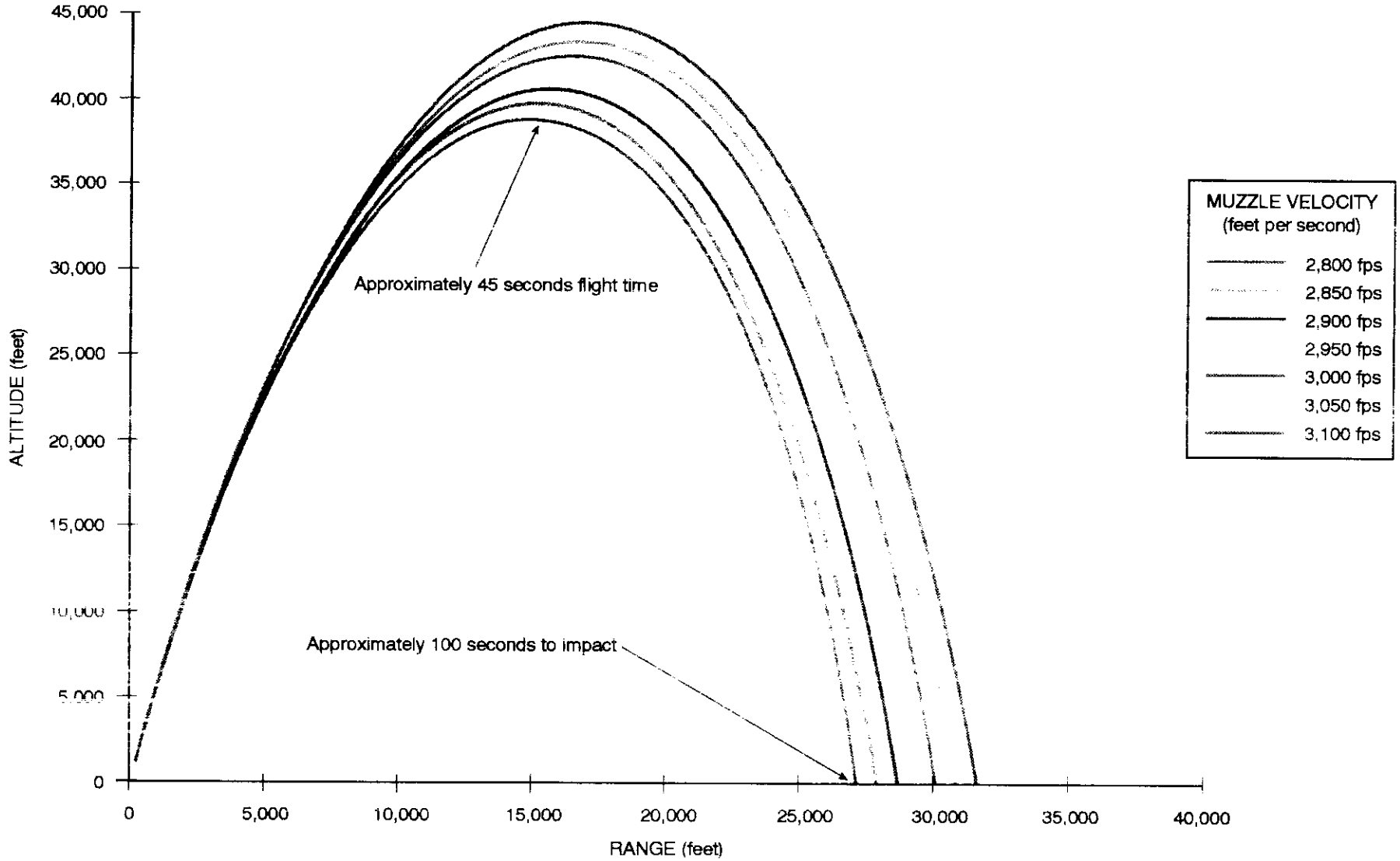

POTENTIAL RANGE OF TRAJECTORIES OF 120mm PROJECTILE FIRED AT 75° ELEVATION

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FIGURE 19

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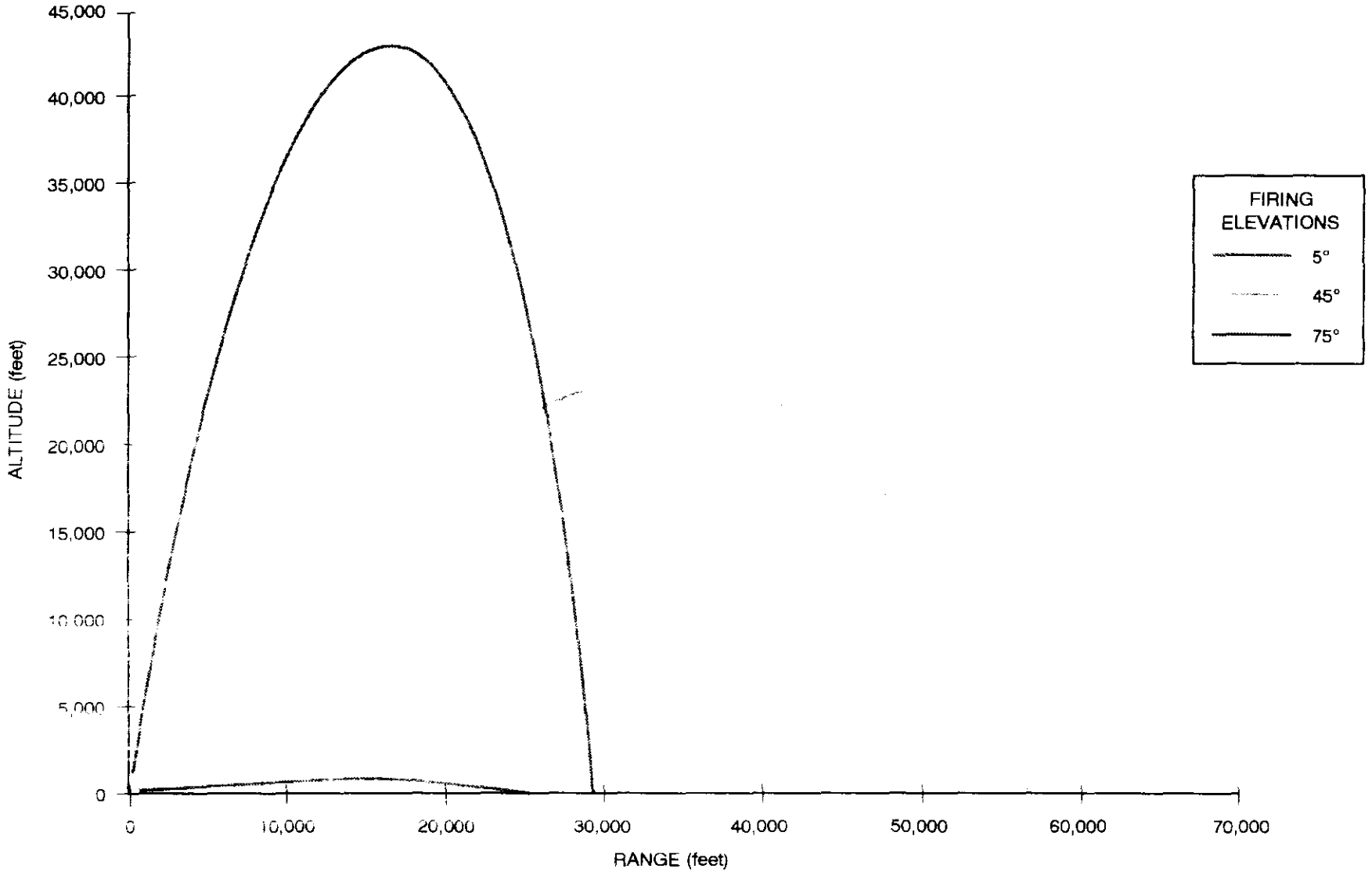

COMPARISON OF 120mm PROJECTILE TRAJECTORIES FIRED AT VARIOUS ELEVATIONS AT A MUZZLE VELOCITY OF 2950 FPS

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FIGURE 20

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In the 1952 Command Report for the 519th AAA Gun Battalion, an entry dated February 27 - 28, 1952, noted that one round did not burst during settling firing of the C Battery guns. Reported attempts to find the round were unsuccessful until October 1952, when a dud round was found and destroyed in the North Slope area.

Using the calculated ranges, based on reported muzzle velocities and "matched" angles of firing of the guns, the following points can be made:

- If the "standard" firing angle for settling, calibration and verification firing was 35° to 45°, these are the same firing angles necessary to achieve the maximum range possible from the 120mm gun.

- Assuming that a typical muzzle velocity was 2,950 fps, the maximum range of a 120mm projectile was nearly 56,000 feet (10.5 miles).

- If a projectile was fused to burst at a 12,000 foot altitude and failed to detonate, it is possible that the projectile could continue to its maximum range before impacting the ground.

- If the fuse failed to function upon impact, as such fuses were designed to do, then, the unexploded projectile could be more than 10.5 miles from the gun from which it was fired.

- The area of a circle with an 10.5 mile radius is about 350 square miles. That is nearly the area of the entire Hanford Site, although firing would not likely have occurred in the direction of the facilities being protected.

- A dud-fired antiaircraft artillery projectile could have impacted nearly anywhere on the Hanford Site.

- Only one dud-fired antiaircraft artillery projectile is recorded in the Command Reports and it appears that this round was eventually found. Based on the rate of dud occurrence for rounds fired, two additional dud-fired antiaircraft artillery projectiles may be present at or near the Hanford Site.

5.5.1.2 Nike Missiles

One Nike missile fuselage was found during a previous investigation on the North Slope, at a former Nike launch site, H-83-L. This area was identified as anomaly #A-2 in the North Slope Expedited Response Action Proposal during a geophysical survey conducted in the summer of 1992. During excavation in June 1994, a six-foot, hollow, steel pipe, one foot in diameter, was identified with an 18-inch by 2 to 5-inch wide tear in it. The USACE-Walla Walla District contractor verified that the pipe was part of a Nike missile, and the empty fuselage was found buried with other trash and debris. According to the USACE, no evidence of stained soil was

observed, and the fuselage appeared to be buried empty. The U.S. Army Yakima Firing Range Explosive Ordnance Detachment confirmed to the USACE that the debris was not considered ordnance, was not a dangerous component of the missile, and was placed back into the landfill as debris and backfilled.

The reviewed records and conducted interviews indicate that the Nike missiles were not fired at the Hanford Site. Therefore, the Nike missile installations do not appear to be associated with OEW hazard.

The missiles were rotated from underground storage to the ready line on a regular basis as part of a maintenance program (Deford, 1992). This involved fueling and defueling the missiles with each rotation. Fueling and defueling was completed in the area of the acid pit which was created for this function. The highest probability of contamination within the Nike launcher areas may include: 1) missile assembly drainage and seepage systems, 2) diesel and fuel oil storage tanks, 3) magazine sump seepage system, and 4) secluded areas adapted to unofficial dumping. Contamination from radar control sites may include: 1) motor pool, 2) septic system, 3) diesel, fuel oil, and gasoline storage tanks, and 4) secluded areas adapted to unofficial dumping (North Slope ERA, 1993).

5.5.1.3 Small Arms Firing Ranges and Munition Caches

Small arms were stored and used at a number of locations at the Hanford Site. Small arms were stored at munition caches and AAA batteries, and used at firing ranges. Three documented firing ranges used at Hanford included Gable Mountain Firing Range, Hanford Firing Range, and the West 300 Area Firing Range (Figure 8). Small arms shooting ranges likely existed at individual AAA batteries. Evidence at such activity has been observed in previous field observations at batteries 501st B, 518th A, and 518th D.

Two high earthen berms provided backstops for small arms shooting practice at battery 501st A; three high earthen berms in a row with each berm used for 30, 38 and 45 caliber weapons were noted at battery, 518th A; and a small shooting range at 518th D indicated evidence of 22 caliber weapons use (Figure 8) (Personal Communication, J. Maas 1994).

Ammunition caches were stored at each of the batteries to provide small arms for men on assignment. There were 16 AAA batteries and at least 1 cache at each battalion. Command reports also identified two ammunition storage sites at Hanford. One was located on the North Slope between the 519th C and 519th D Batteries and the other between the 501st A and 501st C Batteries (Figure 11).

6.0 FINDINGS AND CONCLUSIONS

The Hanford Site is within a remote, rural area of the state of Washington. Since 1943, the area has been government-controlled land with little or no public access. The DOE has agreed to remediate the area based on the Hanford Federal Facility Agreement and Consent Order. Part of the site restoration includes addressing concerns of OEW. The initial phase of the clean-up process of OEW was the completion of an archives search to assess the potential for OEW at the Hanford Site. Presented below are the finding, and conclusions of the OEW archives search.

6.1 FINDINGS

The Army, 5th AAA Group, operated 120mm AAA guns at the Hanford Site during the period March 1950 to December 1957.

Nineteen AAA batteries were located at the Hanford Site. Sixteen of the batteries had AAA installations. Each of these batteries included four 120mm guns (for a total of 64 guns at Hanford). Evidence or records of 120mm guns at the remaining three batteries were not identified. Seven AAA batteries were located on the North Slope, ten in the central area to the east of the ALE, and two in Riverland. No AAA batteries were located on ALE.

The guns had a maximum horizontal range of nearly 11 miles when fired at a 45° angle with a maximum muzzle velocity. Actual firing data indicate that the guns had a maximum range of about 10.5 miles.

Most of the firing training conducted by the 5th AAA Group was at the Yakima Firing Center, Washington. However, the 120mm guns were fired on the Hanford Site during the period of assignment for settling, calibration, and verification firing.

Records document that the 120mm guns on Hanford were fired a minimum of 396 times during the period 1950-1952. Based on an average annual reported rate of fire, it is possible that the guns were fired over 1,000 times at the Hanford Site during the period 1950-1957.

Evidence of firing has been found in both historical records and on-site visits of the North Slope. A "shrapnel" area has been identified by Westinghouse employees near the Columbia River on the North Slope. No physical evidence of firing in the ALE Reserve has been discovered. Physical evidence of firing in the Riverland Area includes empty ammunition cartons for 105mm rounds and clips.

One dud-fired round was reported in the North Slope during the period of 1950 through 1952. Also noted was the destruction of a dud-fired round approximately six months after firing (presumed to be the same round). Firing records for the period 1953 through 1957 were not discovered during the archives search. If the batteries were fired from 1953 through 1957, two

duds may have occurred and the possibility of additional dud-fired rounds (unreported, not found) exist at or near the Hanford Site.

Three firing range areas were used by the Hanford Patrol (Figure 8): 1) one located in the southeast end of the North Slope, on the east side of the Columbia River bank, 2) a second which is still under the control of the Hanford security force is located west of the 300 Area, and 3) a third located on the east end of Gable Mountain.

Ammunition caches were stored at each of the AAA gun batteries to provide small arms for men on assignment. Each of the 16 AAA gun batteries had at least one ammunition cache.

The U.S. Naval Air Station at Pasco (NAS Pasco) was commissioned in 1942. NAS Pasco controlled 18 airfields, primarily for the purposes of conducting air training. Later in 1943, the training was accelerated to conduct advanced training maneuvers, including dive-bombing, aerial gunnery, and rocket firing. Between one and nine of the eighteen airfields were designated for bombing targets. None of the eighteen airfields were located within the Hanford Site, but were between approximately 1.6 (1-mile) and 51.5 (32 miles) kilometers south and east of Hanford.

One Nike fuselage was found at a landfill near a former Nike launch site on the North Slope (H-83-L). The U.S. Army Yakima Firing Range Explosive Ordnance Detachment confirmed that the fuselage was not considered ordnance and not a dangerous component. The fuselage was placed back into the excavated landfill and backfilled.

6.2 CONCLUSIONS

The most significant OEW hazards for the Hanford Site include ammunition storage areas at AAA batteries, munition caches, and unexploded 120mm rounds. Based on the data reviewed for this study, the AAA battery ammunition storage areas and munition caches are known and have been assessed.

Potentially, three unexploded 120mm rounds were fired during the use of the AAA batteries at the Hanford Site. One of the unexploded rounds was apparently found. Two unexploded 120mm rounds may be present on or near the Hanford Site. If these unexploded rounds exist, they may be present in an area of approximately 2,880 square kilometers. Given the small potential of OEW that may be present over such a large area and that the land use of the site may not significantly change in the foreseeable future, we do not recommend field surveys.

TABLE 1
CAMP HANFORD FORWARD POSITIONS
Designated Position Number Changes Held from 1952 to 1959

Jan 1952	July 1954	Jun 1955	Feb 1956	Feb 1959
BC 130	*	*	*	*
BC 210	PSN03	PSN03	H-03-H	H-03-H(V)(1)
518th,B - TC230	PSN 21	PSN 21	H-21	H-21(V)
501st,D - TC255	PSN 70	PSN 70	H-70	H-70(V)
83rd,D - TC275	PSN 71	PSN 71(A)	*	H-71(V)
501st,A - BC300	PSN 61	PSN 61	H-61-H(1)	H-61-H(V)
501st,B - TC310	PSN 51	PSN 51	H-51	H-51(V)
518th,C - TC320	PSN 50	PSN 50	H-50	H-50(V)
518th,A - TC325	PSN 42	PSN 42	H-42	H-42(V)
518th,D - TC330	PSN 40	PSN 40	H-40	H-40(V)
501st,C - TC365	PSN 60	PSN 60	H-60	H-60(V)
83rd,A - BC410	PSN 90	PSN 90	H-90	H-90(V)
519th,D - TC420	PSN 01	PSN 01	H-01	H-01(V)
519th,B - BC500	PSN 10	PSN 10	H-07-H	H-07-H
519th,A - TC505	PSN 12	PSN 12	H-14	H-14(V)
83rd,C - TC515	PSN 72	PSN 72	H-82	H-82(V)
83rd,B - TC525	PSN 80	PSN 80	*	*
519th,C - TC535	PSN 04	PSN 04	H-04	H-04(V)
*	43 R	43 R	H-43-R	H-43 R
*	81 R	81 R	H-81-R	H-81 R
*	*	*	*	H-12 R
*	*	*	*	H-61 R
*	*	H-06-L	H-06-L	H-06-L
*	*	H-06-C	H-06-C	H-06-C

TABLE 1 (Cont.)
CAMP HANFORD FORWARD POSITIONS
Designated Position Number Changes Held from 1952 to 1959

Jan 1952	July 1954	Jun 1955	Feb 1956	Feb 1959
*	*	H-12-L	H-12-L	H-12-L
*	*	H-12-C	H-12-C	H-12-C
*	*	H-52-L	H-52-L	H-52-L
*	*	H-52-C	H-52-C	H-52-C
*	*	H-83-L	H-83-L	H-83-L
*	*	H-83-C	H-83-C	H-83-C

BC = Base Camp *(A) = Abandoned* *C = Nike Missile Control Site*
TC = Tent Camp *(V) = Vacated* *(R) = Radar*
PSN = Position * = Not Shown *518th, B = Battalion and Battery No.*
H- = Position *R = Radar* *L = Nike Missile Launch Site*
-H = Headquarters

Note: Table modified from Air Defenses of Hanford, Camp Hanford, The Forward Positions 1950-1964. List by J. Maas, COE, Seattle District dated July 10, 1993.

(1) H-03-H and H-61-H positions located in the Central Area remain relatively intact. Neither positions show signs of the former presence of gun installations (Personal Communication, J. Maas 1994)

TABLE 2
CALCULATED MAXIMUM ALTITUDES AND RANGES FOR VARYING MUZZLE VELOCITIES AND FIRING ANGLES FOR 120MM ANTIAIRCRAFT ARTILLERY

Gun Elevation	2800 fps		2850 fps		2900 fps		2950 fps		3000 fps		3050 fps		3100 fps	
	Altitude	Range	Altitude	Range	Altitude	Range	Altitude	Range	Altitude	Range	Altitude	Range	Altitude	Range
5°	676	24,033	696	24,700	715	25,300	735	26,000	735	26,700	775	27,500	795	28,280
15°	4,225	40,480	4,328	41,300	4,430	42,000	4,500	42,900	4,600	43,800	4,740	44,600	4,844	45,555
25°	9,300	48,069	9,500	49,000	9,700	50,000	9,940	50,700	10,200	51,600	10,400	52,500	10,600	53,400
35°	15,300	51,745	15,650	52,800	16,000	53,900	16,400	55,000	16,700	56,100	17,065	56,900	17,400	58,000
45°	21,800	**52,300**	22,300	**53,500**	22,800	**54,500**	23,300	**55,700**	23,900	**56,880**	24,400	**58,100**	24,900	**59,300**
55°	28,300	48,790	29,000	49,900	29,700	51,100	30,300	52,300	31,000	53,500	31,700	54,800	32,500	56,100
65°	34,100	40,444	35,000	41,500	35,800	42,500	36,700	43,600	37,600	44,700	38,500	45,900	39,300	47,000
75°	*38,600*	27,000	*39,600*	27,800	*40,600*	28,600	*41,600*	29,300	*42,600*	30,100	*43,600*	30,900	*44,700*	31,700

Notes: Altitude and range in feet.
Muzzle velocity in feet per second (fps)
Bold indicates maximum range for indicated muzzle velocity.
Italics indicates maximum altitude for indicated muzzle velocity.

TABLE 3
GLOSSARY OF ACRONYMS

AAA	—	antiaircraft artillery
AEC	—	Atomic Energy Commission
ALE	—	Fitzner/Eberhardt Arid Lands Ecology Reserve
CERCLA	—	Comprehensive Environmental Response Compensation and Liability Act
COE	—	U.S. Army Corps of Engineers
DOE	—	U.S. Department of Energy
EOD	—	explosive ordnance disposal
EPA	—	U.S. Environmental Protection Agency
fps	—	feet per second
MED	—	Manhattan Engineer District
mil	—	a unit of angular measurement equal to 1/6,400 of 360 degrees and used especially in artillery
mm	—	millimeter
MSL	—	mean sea level
MT fuse	—	mechanical time fuse
NARA	—	National Archives and Records Administration
OEW	—	ordnance and explosive waste
RCRA	—	Response Conservation and Recovery Act
WSU	—	Washington State University
VT fuse	—	Variable time fuse
YFC	—	Yakima Firing Center

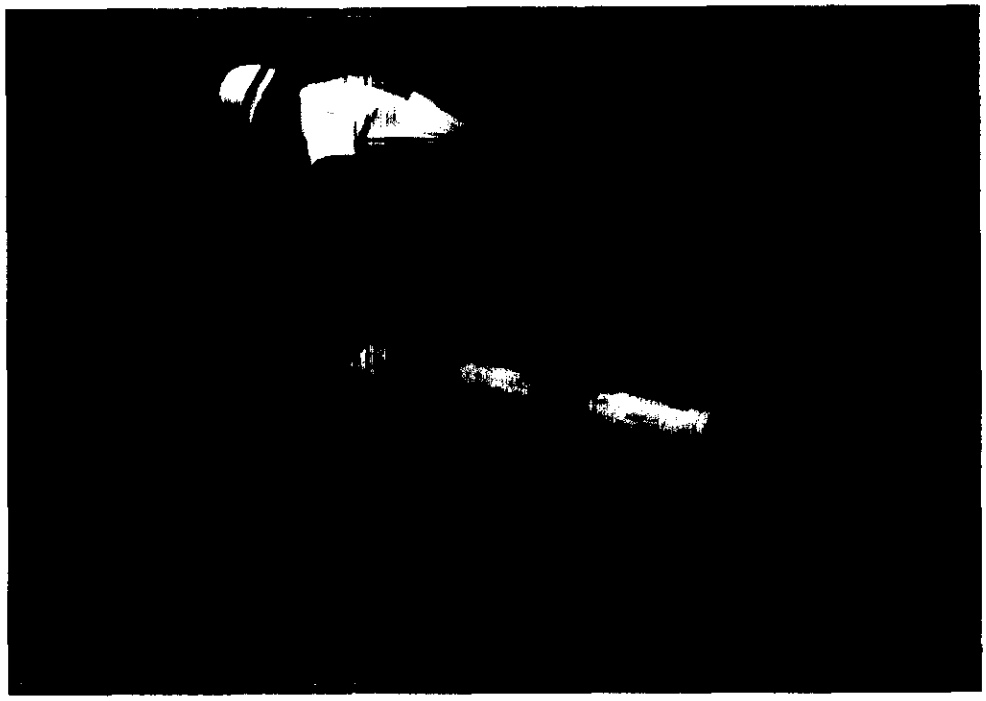

PHOTO #1 – Uncovered fuselage portion of a NIKE Ajax missile from H-83-L landfill on the North Slope

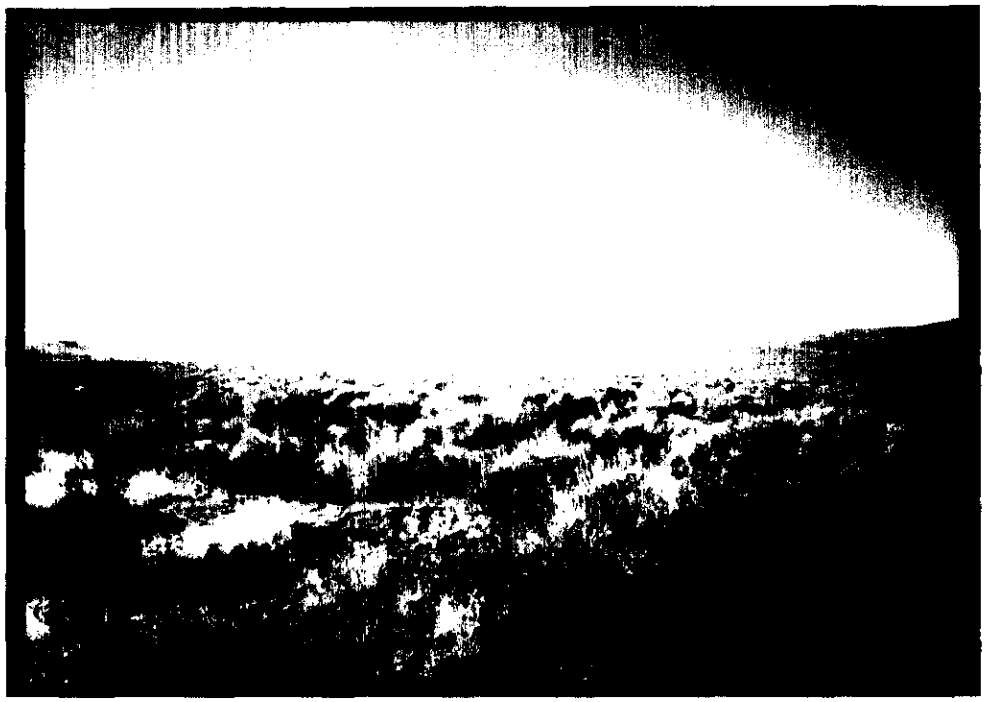

PHOTO #2 – View of Riverland, looking southwest.

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PHOTO #3 – View of Riverland, looking west toward Yakima.

PHOTO #4 – View of Riverland, looking northeast toward the North Slope.

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PHOTO #5 – PSN 90 on the North Slope, formerly occupied by Battery 83rd "A"Antiaircraft Artillery Gun Battalion.

SOURCE: U.S. Army Corps of Engineers, Hanford Program Office, Richland, Washington

AERIAL PHOTOGRAPH

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PHOTO #6 – Trees mark site of former AAA Battery 518th "C," looking northeast.

SITE PHOTOGRAPH

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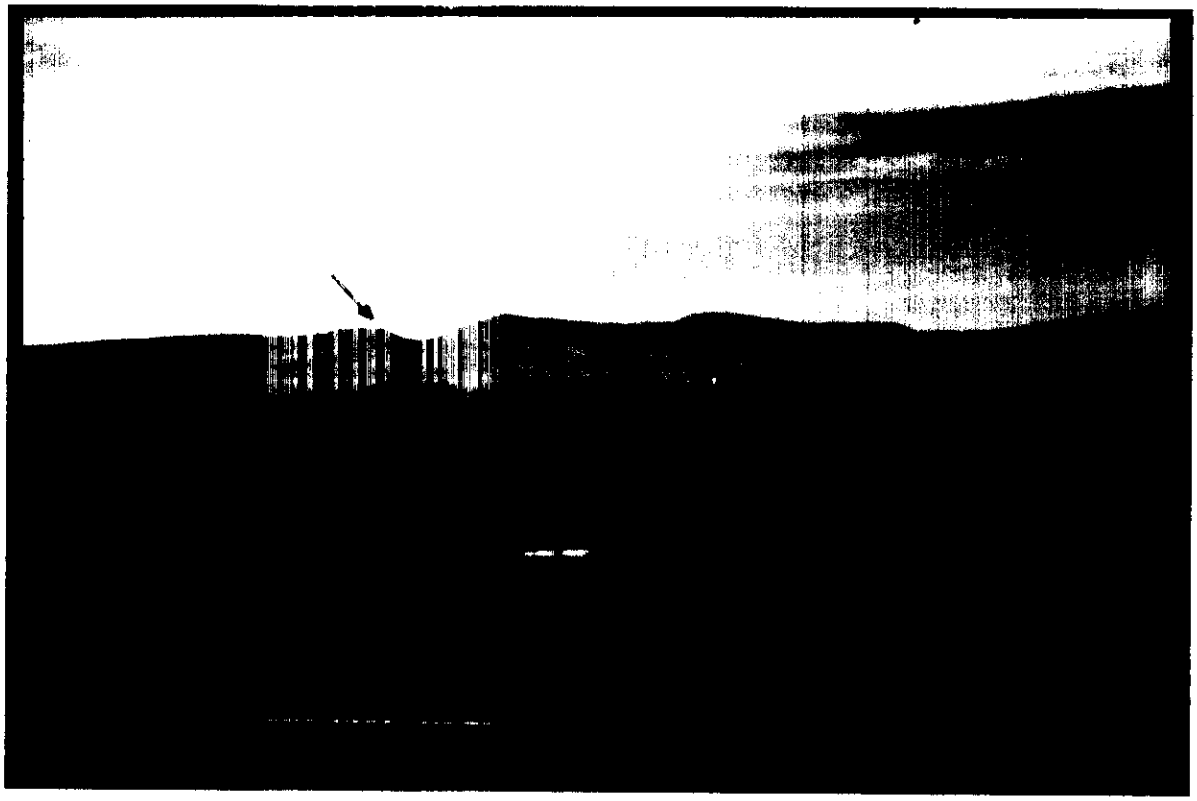

PHOTO #7 – Trees mark site of former NIKE Battalion Headquarters at PSN 07/10 on the North Slope, looking north with Saddle Mountain in background. Arrow indicates location of H-06-C.

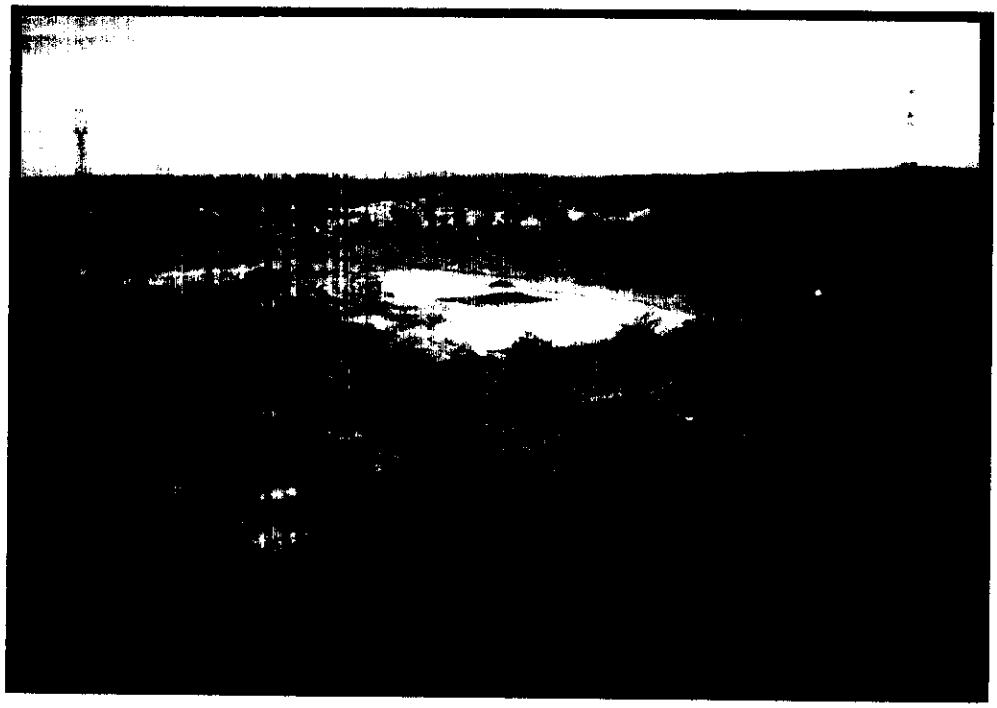

PHOTO #8 – H-12-L former NIKE launch site on the North Slope, looking southwest.

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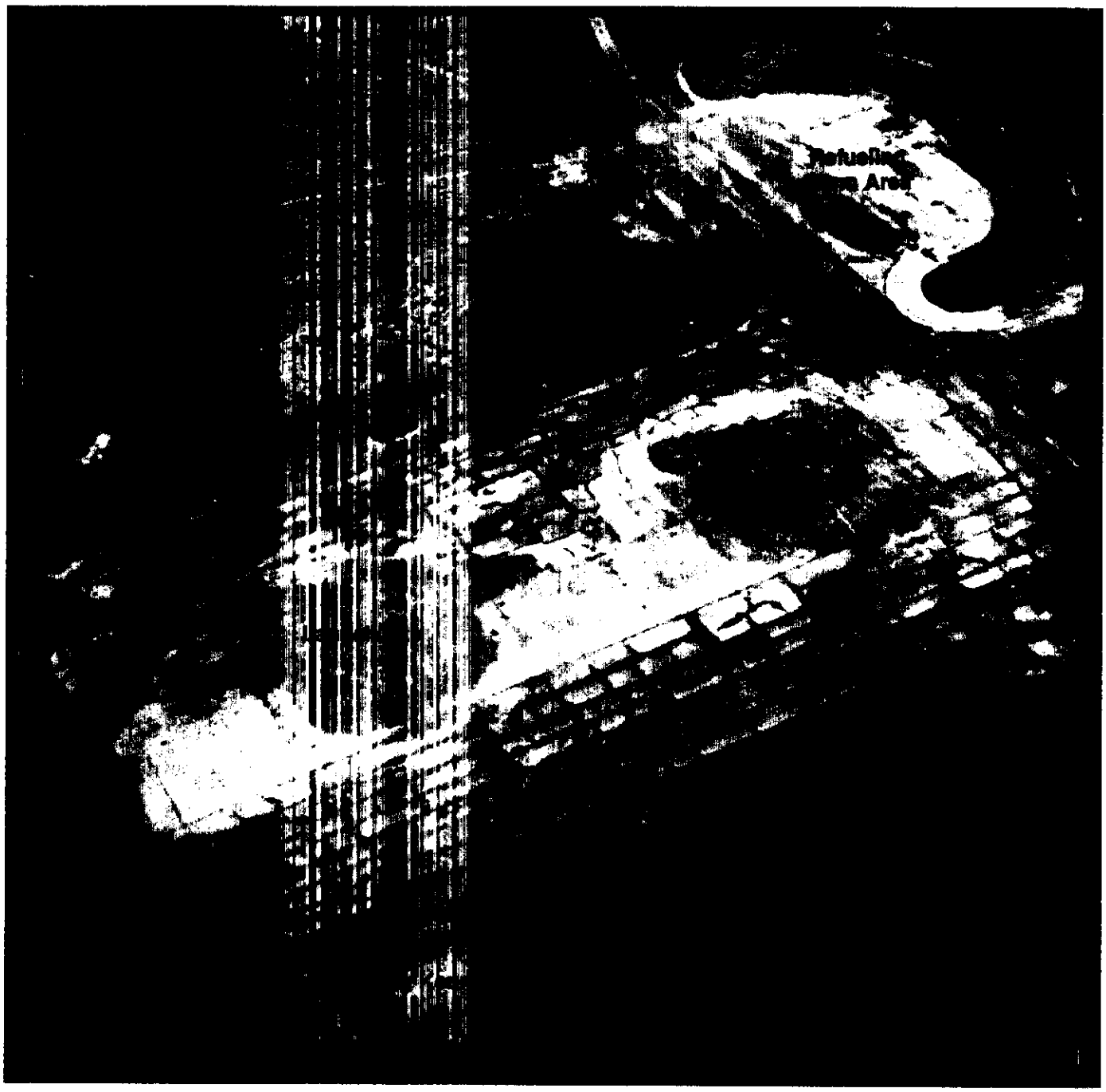

PHOTO #9 – Former NIKE Missile Launch Site, located on the North Slope, Position H-06-L.

AERIAL PHOTOGRAPH

SOURCE: U.S. Army Corps of Engineers, Hanford Program Office, Richland, Washington

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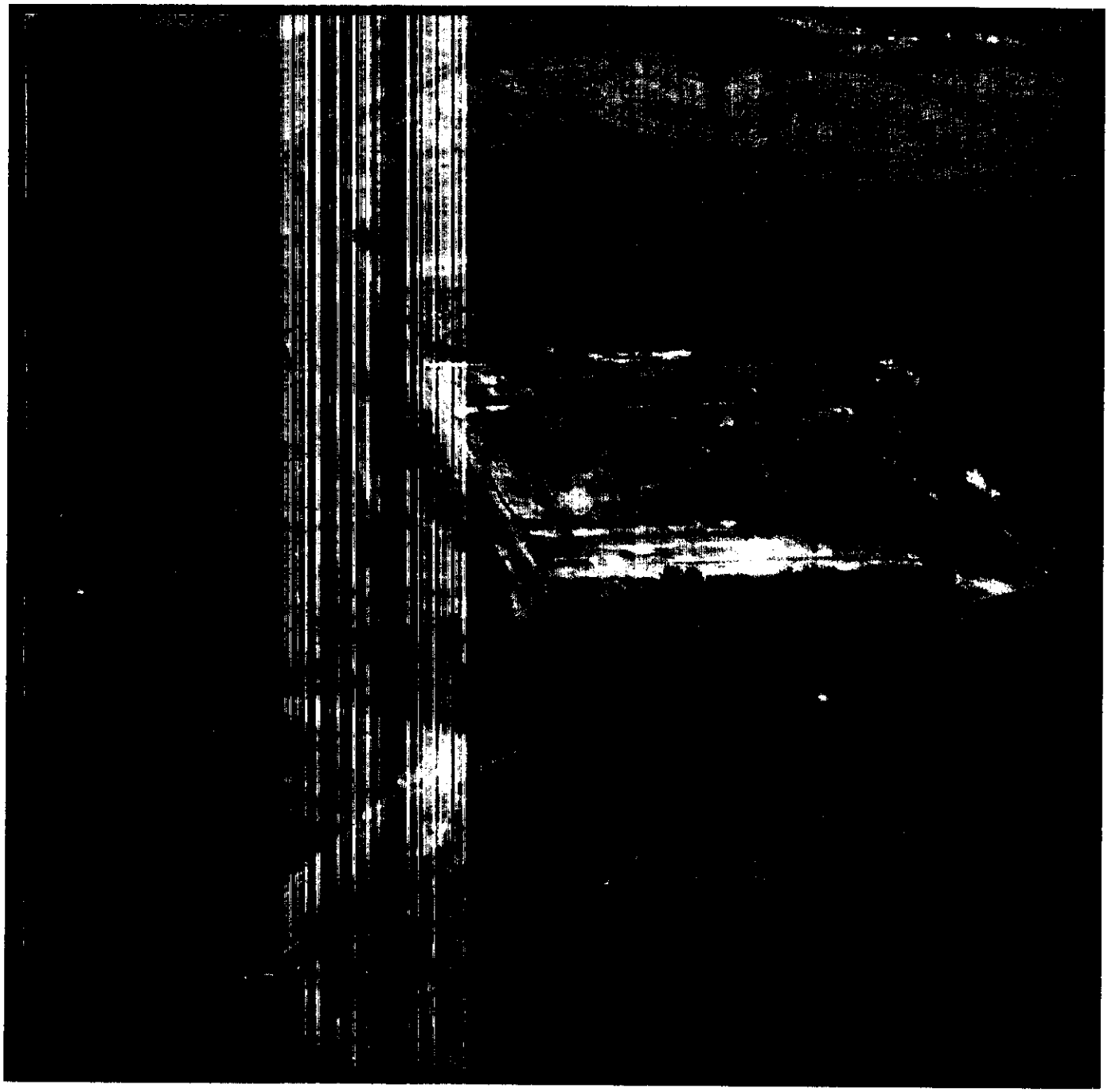

PHOTO #10 – Former NIKE Headquarters location, H-06-HQ on the North Slope. H-06-L launch site is partially visible in the upper right portion of photograph.

AERIAL PHOTOGRAPH

SOURCE: U.S. Army Corps of Engineers, Hanford Program Office, Richland, Washington

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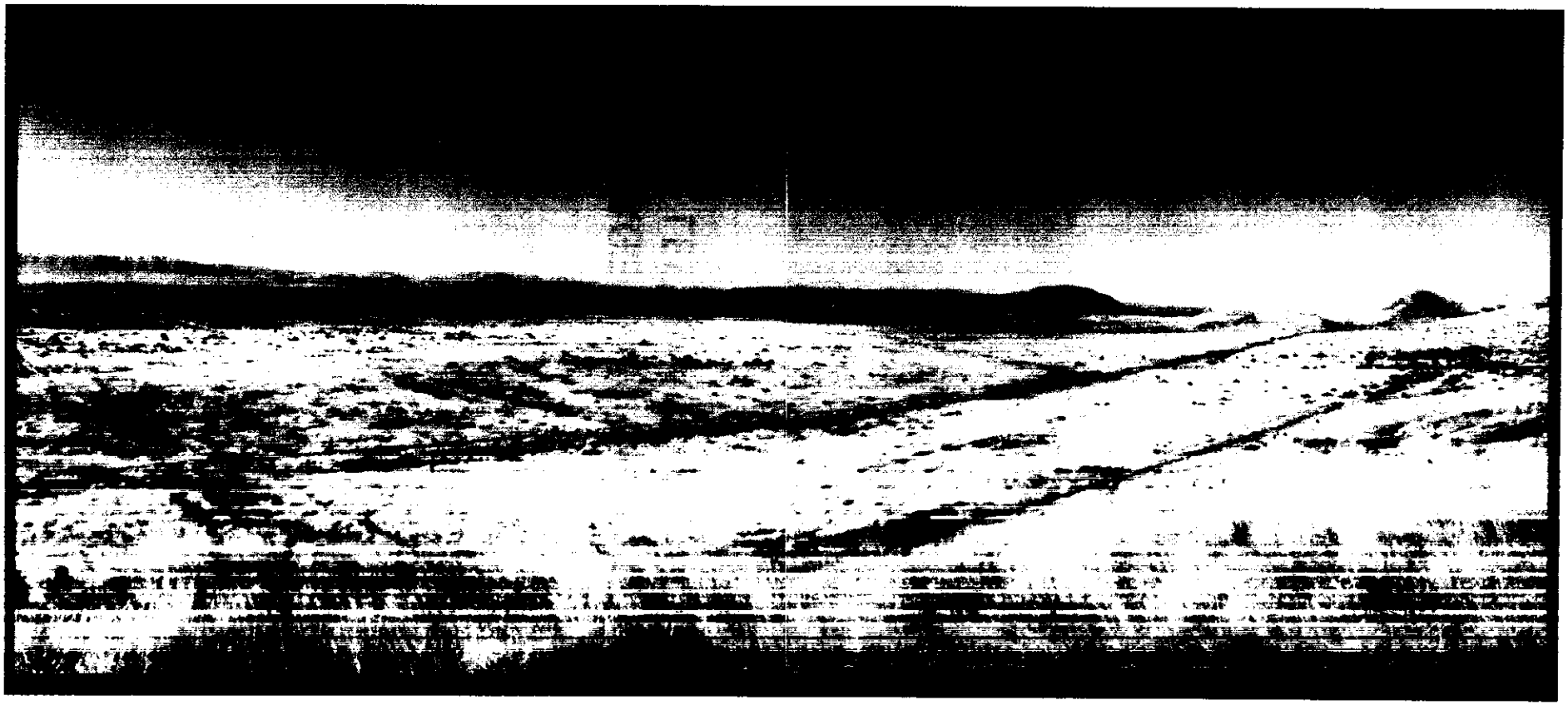

PHOTO #11 – View of the North Slope, looking south and southwest. Ruts in the road were made by Army vehicles heading to the .50 caliber range.

SITE PHOTOGRAPH

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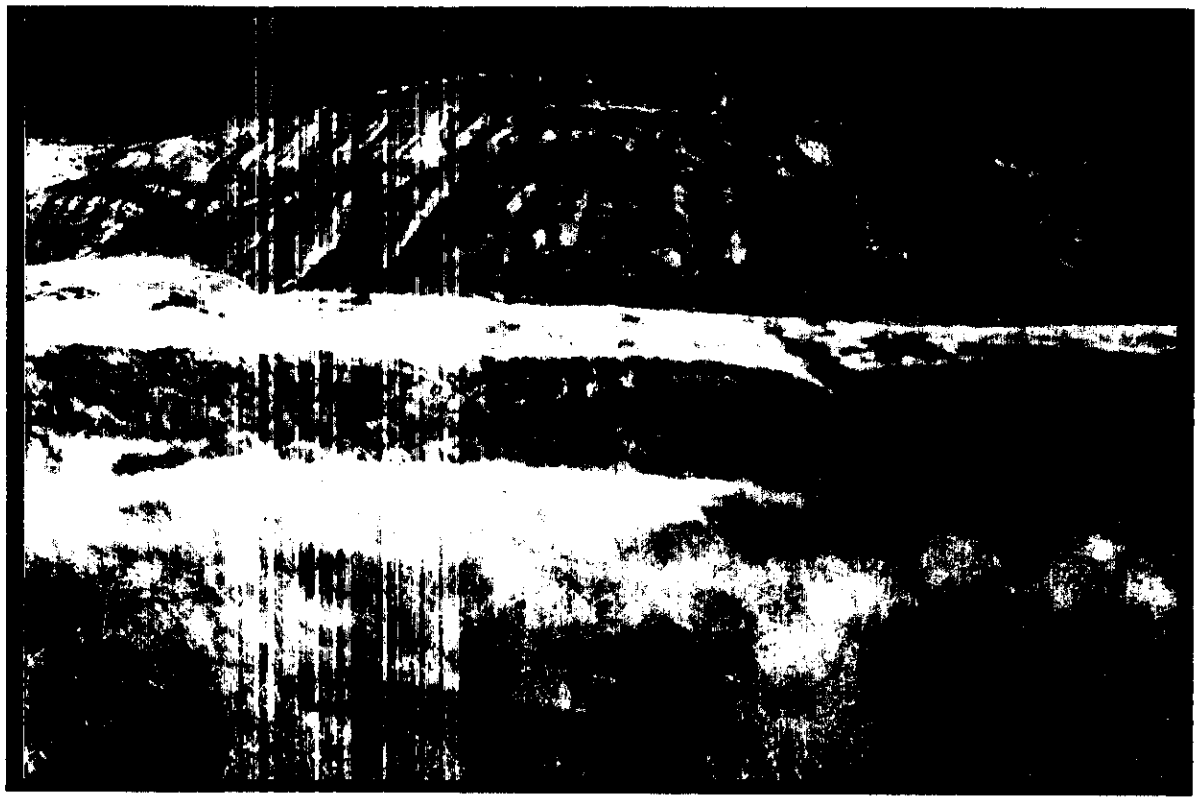

PHOTO #12 – Fired .50 caliber slugs can be found on the North Slope, in the sand bank located in the center of the photograph.

PHOTO #13 – View of the North Slope, looking east.

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PHOTO #14 – Empty 105mm cartons observed at Riverland.

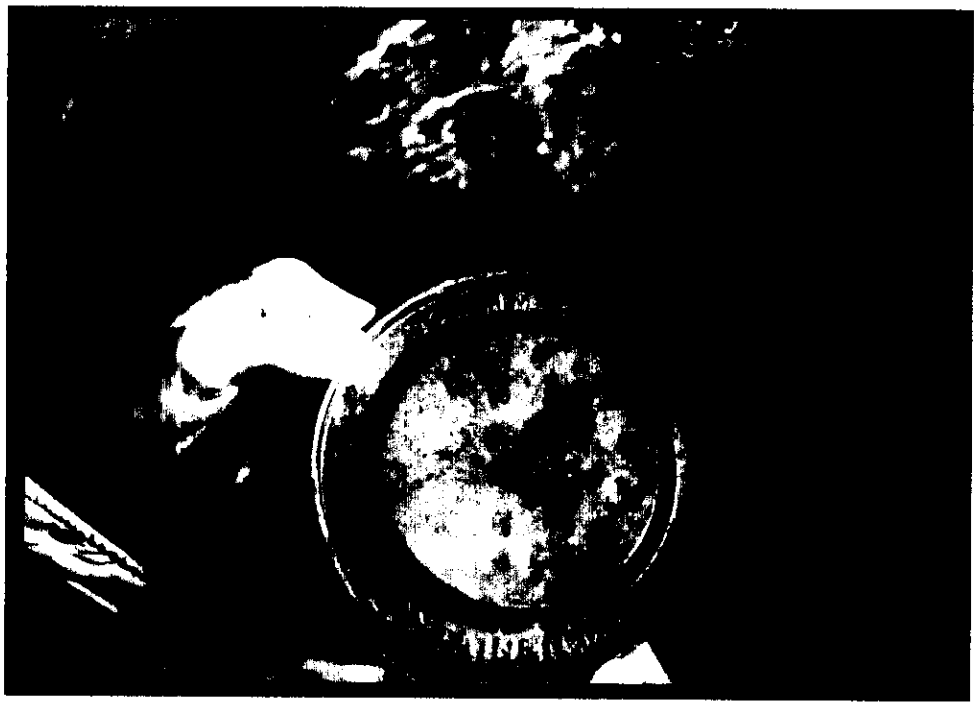

PHOTO #15 – Lid of 105mm carton at Riverland.

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PHOTO #16 – NIKE missile firing area on Fitzner/Eberhardt Arid Lands Ecology Reserve.

SOURCE: U.S. Army Corps of Engineers, Hanford Program Office, Richland, Washington

SITE PHOTOGRAPH

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PHOTO #17 – Entrance to former underground NIKE missile storage area (converted to a bunker) on Fitzner/Eberhardt Arid Lands Ecology Reserve.

SOURCE: U.S. Army Corps of Engineers, Hanford Program Office, Richland, Washington

SITE PHOTOGRAPH

US Army Corps of Engineers
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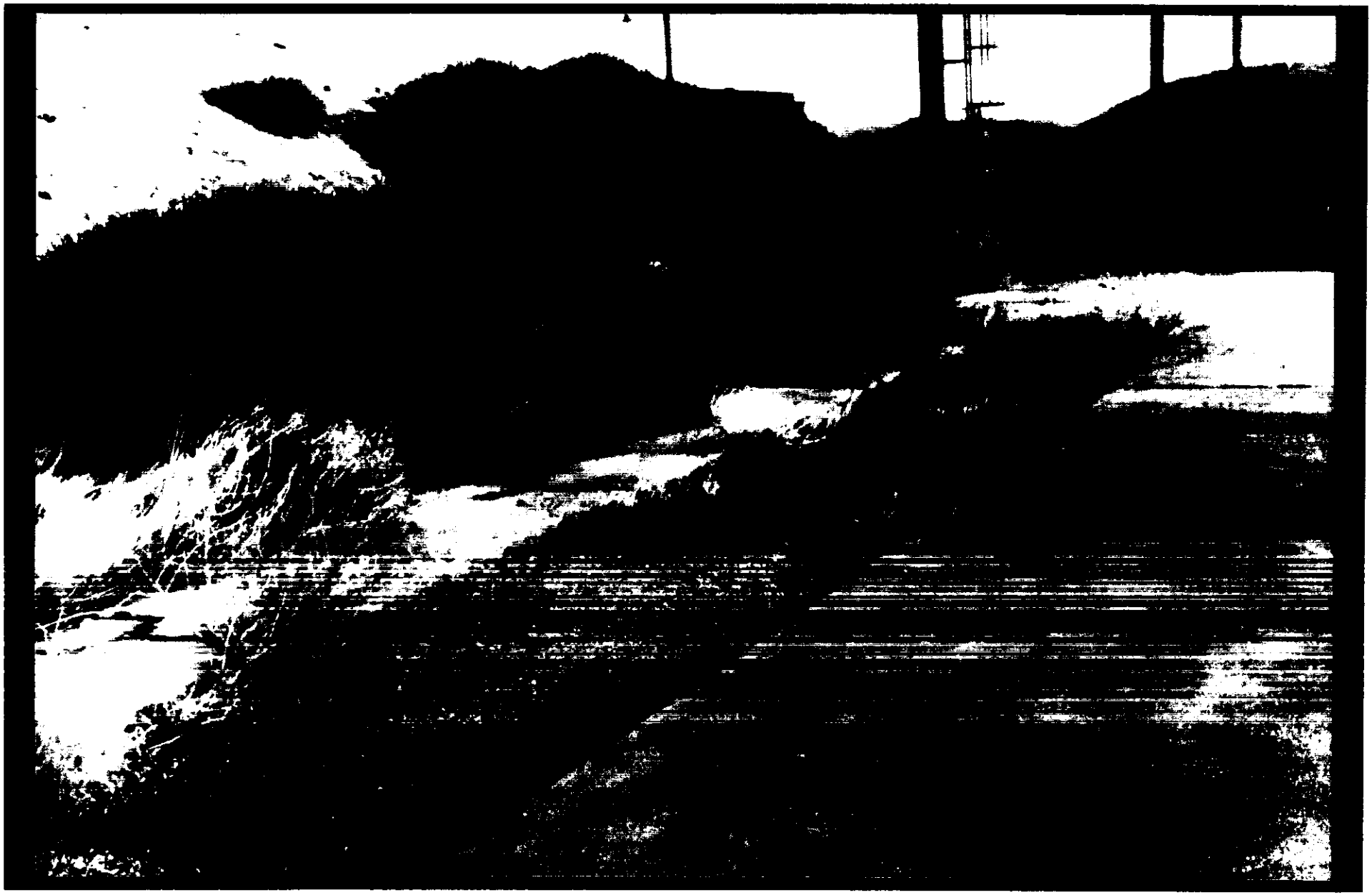

PHOTO #18 – NIKE missile refueling area on Fitzner/Eberhardt Arid Lands Ecology Reserve.

SOURCE: U.S. Army Corps of Engineers, Hanford Program Office, Richland, Washington

ARID LANDS ECOLOGY RESERVE PHOTOGRAPH

US Army Corps of Engineers
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PHOTO #19 – NIKE missile landfill on Fitzner/Eberhardt Arid Lands Ecology Reserve.

SOURCE: U.S. Army Corps of Engineers, Hanford Program Office, Richland, Washington

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US Army Corps of Engineers
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7613-021-005 Hanford, Washington

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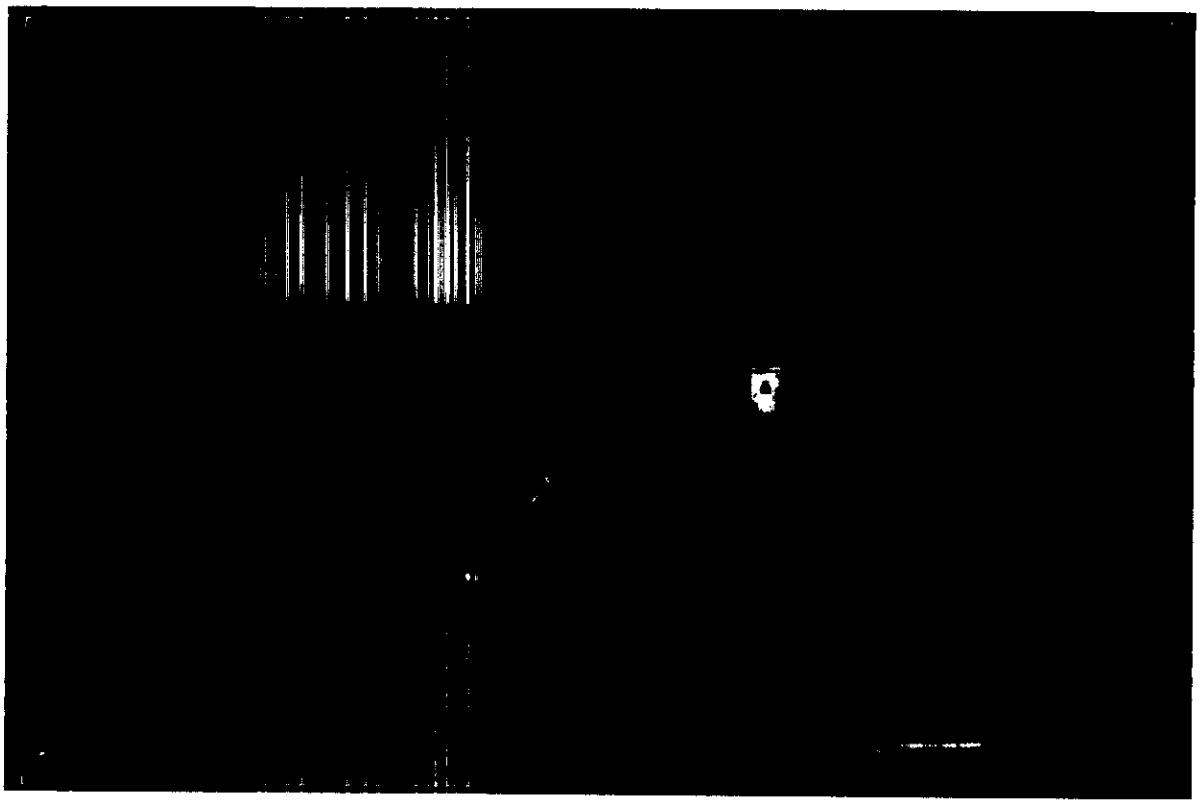

PHOTO #20 – H-52-L North Bunker entrance on ALE Reserve. Soil mound covers where missile elevator doors were once located.

PHOTO #21 – H-52-L North Bunker (Former Missile Storage Area). Wood ceiling, columns and concrete foundation recently installed.

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PHOTO #22 – H-52-L tunnel between North Bunker and South Bunker.

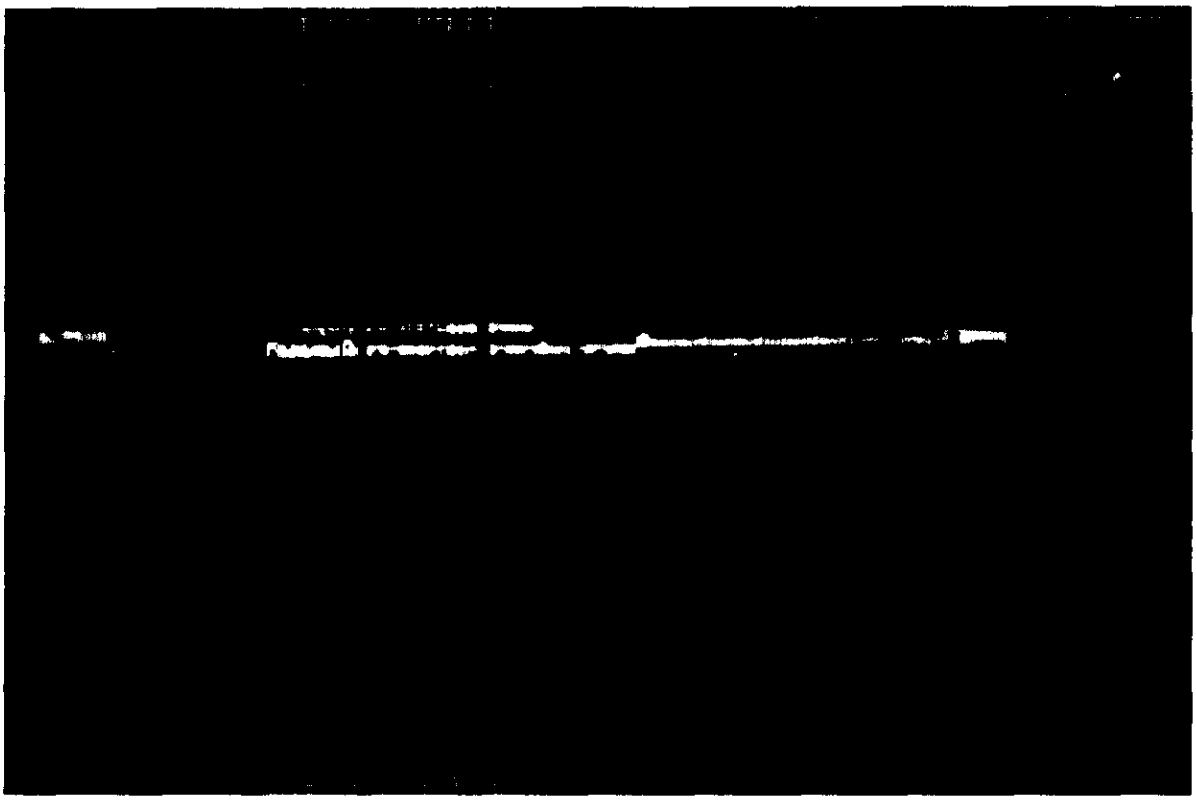

PHOTO #23 – H-52-L Headquarters Buildings (barracks, mess hall, offices).

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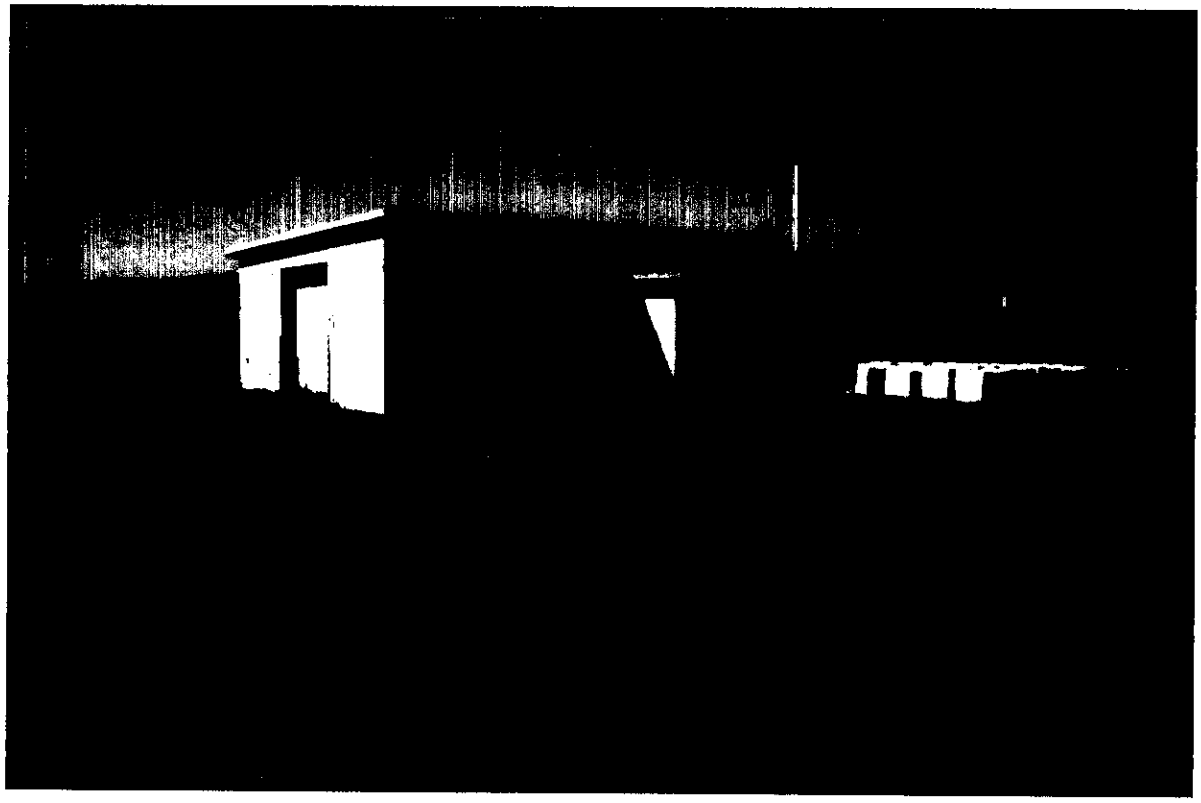

PHOTO #24 – H-52-L Missile Assembly Building.

SITE PHOTOGRAPH

US Army Corps of Engineers
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APPENDIX A

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APPENDIX B
Summary of Work Performed

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APPENDIX B
Summary of Work Performed

A brief summary of the information collected from depositories and interviews conducted by Dames & Moore was presented in Section 4.0, Hanford Ordnance and Explosive Waste Research. The following pages provide a more detailed listing of the information obtained at each location and from the interviews completed.

DEPOSITORIES

November 16, 1993

U.S. Soil Conservation Service, Franklin County, Washington

Mr. Stillings and Ms. Neketuk representatives received soil classification descriptions from the Franklin County Soil Conservation Service office to be used to describe the various soil types identified at Hanford.

Washington State University, U.S. Department of Energy, Public Reading Room, Richland, Washington

Dames & Moore conducted an archive search of the Washington State University, DOE, Public Reading Room in Richland, Washington. Research staff included Mr. Duane Stillings and Ms. Keely Neketuk. The Washington State University Public Reading Room contains documents prepared for, or by the DOE, related to the Hanford Site. Librarians are available to show how to use the repository to retrieve the data of interest.

Dames & Moore representatives reviewed indexes and identified several books and other published material on the Hanford Nuclear Plant. Documents reviewed included a historical perspective on how the site was selected, land uses prior to its occupation, the production of nuclear energy, those scientists involved in the production of nuclear fission and the scientific revolution, the urgency under which the U.S. Department of War was working to produce the first nuclear bomb and use it to end World War II, and the contamination that resulted from the nuclear production activities. Books were not found to indicate the history of military defense activities relative to antiaircraft artillery, or U.S. Army records of the specific battalions activated to defend the Hanford Production Plant. Books reviewed at this repository included:

- History of the Production Complex: The Methods of Site Selection, September 1987, History Associates, Inc.
- On the Home Front, The Cold War Legacy of the Hanford Nuclear Site, 1992, Michelle Gerber, PhD Historian.

- U.S. Army in World War II, Special Studies, Manhattan: The Army and the Atomic Bomb, 1985, Vincent C. Jones.

- Manhattan District History: Book IV - Pile Project X-10 Volume 4 - Land Acquisition, Hanford Engineer Works, Declassified Document, U.S. Government (author/agency not indicated)

November 16-18, 1993

Westinghouse Hanford Company, Environmental Resource Center, 740 Building, Richland, Washington

Dames & Moore researchers, Mr. Stillings and Ms. Neketuk conducted a review of Environmental Resource Center at Westinghouse Hanford Company. Ms. Gaye Fitzgibbons, Specialist with the Environmental Resource Center provided assistance in locating information for Dames & Moore. Westinghouse Hanford Company is the operations and engineering contractor leading cleanup and environmental restoration of Hanford. Many documents written by Westinghouse Hanford Company held at the Environmental Resource Center were made available for review. A listing of the resources on file were reviewed to identify possible records relevant to this study. The documents on file were primarily related to the contamination associated with the nuclear production. However, a few documents were useful and were checked out and copied at a local copy service. The following records were reviewed and copied as need:

- Geology and Hydrology of the Hanford Site: A Standardized Text for Use in Westinghouse Hanford Company Documents and Reports, July 1990, C.D. Delaney

- An Aerial Radiological Survey of the Hanford Site and Surrounding Area, October 1990, by EG&G Energy Measurements and Remote Sensing Laboratory

For additional geological information, Ms. Fitzgibbons referred Dames & Moore to Dr. Stephen Reidel, the lead geologist for Westinghouse who has authored several documents describing the geology of Hanford. Dr. Reidel provided several recent papers for Dames & Moore to use. The documents provided were:

- Geologic Map of the Priest Rapids 1:100,000 Quadrangle, Washington (undated), compiled by S.P. Reidel and K.R. Fecht.

- Late Cenozoic Structure and Stratigraphy of South-Central Washington, Bulletin 80, September 1, 1993, by S.P. Reidel, et al.

- Field Trip Guide to the Hanford Site, November 1992, by S.P. Reidel, et al.

- Compilation Geologic Map of the Pasco Basin, South Central Washington, 1979, Rockwell Hanford Operations, Richland, Washington

November 17, 1993

ICF Kaiser Engineers Hanford Company, 200 East Area, Survey Office

ICF Kaiser Engineers Hanford Company provides architect-engineer and construction services for the Hanford Site. Mr. Stillings and Ms. Neketuk met with Mr. Verne Coyne, Surveyor at ICF Kaiser Engineers as recommended by Mr. Perro to review the available maps on file in Mr. Coyne's office. Mr. Stillings and Ms. Neketuk found several survey drawings dated from 1952 to 1959 which illustrated the locations of military positions at Hanford. These documents were at one time classified and restricted material. One of the maps identified where two "ammo storage areas" were located. One storage area was located on the North Slope, between Tent Camps 420 and 535, and the other, between Tent Camps 300 and 365, east of the Arid Lands Ecology Reserve and Highway 240. Mr. Coyne gave Dames & Moore permission to reproduce the maps. Mr. Coyne referred Dames & Moore to Mr. Spencer Compton, a retired ICF Kaiser Engineers surveyor. See Interviews below for information provided by Mr. Compton.

MACTEC, Richland, Washington

Mr. Stillings met with Mr. Jerry Yesberger, former DOE Safety Officer was interviewed by Dames & Moore, as recommended by Mr. Perro with the COE. Mr. Yesberger indicated that a practice range was used and evidence of mortar was found around Gable Mountain, the old Hanford townsite, and across the river from the F reactor in the flat area of Section 21.

Richland Police Department, Richland, Washington

Mr. Stillings and Ms. Neketuk interviewed Lieutenant Panther, Bomb Disposal Leader was interviewed to identify whether the Richland Police Department records have information pertaining to identified exploded or unexploded ordnance. Lieutenant Panther is not aware of any incidents related to Hanford and ordnance issues and they do not have a system that would record this information.

U.S. Soil Conservation Service, Benton County, Washington

One November 17, 1993, Mr. Stillings and Ms. Neketuk visited the office and obtained a copy of the Soil Survey, Benton County Area.

Westinghouse Hanford Company, Environmental Resources Center, 740 Building, Richland, Washington

Mr. Jonathan Lucas, Engineer with Westinghouse was interviewed by Ms. Neketuk because he conducts regular field investigations at Hanford. Mr. Lucas indicated that the investigations he

is involved in focus on flora and fauna issues. Mr. Lucas indicated Dames & Moore should talk with Mr. Deford for historical information relative to military history and ordnance data.

Westinghouse Hanford Company, Record Holding, 712 Building, Richland, Washington

As recommended by Mr. Walter Perro, Mr. Stillings and Ms. Neketuk visited the Record Holding office. The Record Holding office contains historical maps and aerial photographs of the Hanford Site. Ms. Sylvia Spiel, Records Specialist, provided a stack of photographs to go through, dated between 1951 and 1952. None of the photographs showed coverage of military operations, evidence of ordnance related activities or weapon ranges.

November 18-19, 1993

U.S. Army Corps of Engineers, Hanford Program Office, Richland, Washington

Mr. Stillings and Ms. Neketuk of Dames & Moore visited the COE, Hanford Program Office in Richland, Washington and met with Mr. Walter Perro, Unit Manager for the North Slope and ALE. Mr. Perro provided Mr. Stillings and Ms. Neketuk with numerous documents, reports, maps and a list of several people that may have information. Reports provided by Mr. Perro included the Manhattan Project Buildings and Facilities at the Hanford Site: A Construction History, September 1993, by M. Gerber, Ph.D; North Slope Expedited Response Action Proposal, February 1994; and records of NIKE missile sites.

November 19, 1993

Westinghouse Hanford Company, Environmental Resource Center, 740 Building, Richland, Washington

Mr. D.H. DeFord, Historian with Westinghouse was interviewed by Mr. Stillings and Ms. Neketuk as he has researched the history of Camp Hanford and data related to ordnance issues was addressed in his study. Mr. Deford knew that several artillery sites were located at Hanford. Rumors were investigated, including one that involved the possibility of a cache of arms buried in a shallow grave near one of the artillery sites. Mr. Deford completed several interviews and was not able to find firm evidence that munitions were buried. Mr. Deford indicated that in the Juniper Forest Area (in north Franklin County, north of the Columbia River) "war games" or tactical maneuvers were believed to be conducted between 1966 and 1969. Several memos were provided for review by Dames & Moore including notes from a field trip completed in July 1992, summarizing records reviewed related to antiaircraft artillery activities and the NIKE missile sites at Hanford.

Mr. Paul Valcich, Engineer with Westinghouse was interviewed by Mr. Stillings and Ms. Neketuk relative to his findings at Riverland which he has been investigating for over a year. Mr. Valcich has seen evidence of military activities in the southeast corner of Riverlands. A copy of the Riverland Expedited Response Action Proposal dated April 1993 was provided for

our review. Mr. Valcich saw evidence of live and spent ammunition, military rations containers and other materials indicating a miliary presence in the southwest corner of Riverlands. Evidence was also reported of a machine gun post, tank tracks, and antiaircraft artillery pieces on a ridge overlooking the river in the east-central portion of Riverlands.

November 30, 1993

U.S. Army Corps of Engineers, Seattle, Washington

Mr. Stillings and Ms. Neketuk of Dames & Moore met with Mr. Jonathan Maas, Environmental Protection Specialist, and Dr. David Rice, Chief, River Basin Studies as recommended by Mr. Perro since they have completed extensive military history research on Hanford for the past several years. According to Mr. Maas, he became involved in identifying formerly used defense sites (FUDS) from 1986 to 1993. One of the project sites included Camp Hanford. After nine field trips, Mr. Maas did not identify a single live round at Hanford.

Rumors of munitions located at Hanford were investigated. One location included the east end of Gable Mountain where there was a shooting range. According to the rumors there were buried arms privately stashed, between Hanford Ferry and White Bluffs Ferry. Evidence of the "stashes" were never found.

Dr. David Rice has been involved in conducting research at Hanford since 1968, at first as a contractor to the Atomic Energy Commission (AEC). His early involvement pertained to radiological issues. In 1974, the AEC decided to investigate areas along the Columbia River to release public recreational areas along the Columbia River and clean up debris. Trash heaps, huts, structures, combines and antiaircraft sites were evaluated. From 1974 to 1978, Dr. Rice was contracted by the AEC to preserve certain articles found. There was no ordnance found. In 1986, Dr. Rice worked with Mr. Maas as part of the FUDS project. Findings at Hanford included homesteads and gas well sites on the Arid Lands Ecology Area. Not much evidence of the military camps or aircraft batteries were found because they had been demolished previously.

Mr. Maas and Dr. Rice provided a summary of their findings in a document called, Air Defenses of Hanford, Camp Hanford, the Forward Positions, 1950-1964. Other documents included notes from the field trips that were completed between 1986 and 1993. Several maps were provided to show forward areas. One document provided that was especially useful included the camp number designations that had changed often between 1952 and 1959. This helped to verify tent camp numbers that may have been assigned various numbers during those years.

November 30 and December 1, 1993

U.S. National Archives and Records Administration, Pacific Northwest Region, Seattle, Washington

Mr. Stillings and Ms. Neketuk of Dames & Moore visited the National Archives and Records Administration as recommended by Mr. Maas, a possible source of military records. Ms. Susan Karren, Assistant Director/Archivist provided hundreds of files containing military records. The documents were reports from the General Service Administration, Real Property Division; War Assets Administration; and Accession. These documents provided a listing of owners, acreage, and lease agreements in Pasco, Washington. No maps were attached making it difficult to identify the actual locations. Most properties appeared to be used by the Naval Air Station in Pasco, Washington for landing strips in the 1940s. Other records included the sale of power lines that serviced two NIKE missile sites; Moses Lake Bombing and Gunnery Range (north of the Hanford Site); Ephrata Air Force Base was partially transferred to the Bureau of Land Management; copies of Navy flying manuals. No significant findings specifically related to Hanford military activities was identified.

December 2, 1993

Fort Lewis Explosive Ordnance Disposal (EOD), Fort Lewis, Washington

Mr. Stillings contacted Staff Sergeant Udelhofen. Staff Sergeant Udelhofen was on-site at the North Slope about three years ago. He did not recall of any incidents related to unexploded ordnance. Staff Sergeant Udelhofen suggested that Range Control may have information.

Fort Lewis Museum, Fort Lewis, Washington

Mr. Stillings also contacted the Fort Lewis Museum, recommended by Ms. Karren, to determine if there was any historical information at the museum related to Hanford. Mr. Craig Haggy, Director of the museum was contacted to determine if information was available pertaining to Hanford military records historical photographs, or artillery displays used in the 1950s. Mr. Haggy indicated that does not have information on Hanford.

December 7-8, 1993

U.S. Army Corps of Engineers, Huntsville, Alabama

Mr. Stillings and Ms. Neketuk of Dames & Moore met with Mr. Charles Heaton, Project Manager to review files that pertain to the military records and types of ordnance used by the U.S. Army. Several documents were provided by Mr. Heaton including:

- Defense Environmental Restoration Account (DERA) Inventory Project Report, Camp Hanford, Washington October 1986, J. Maas and D. Rice, Ph.D., COE, Seattle, Washington;
- Safety & Health Plan, Arid Lands Ecology Reserve, July, 1993, COE;
- Arid Lands Ecology Facility Management Plan, February 1993, Battelle Memorial Institute;
- Draft, Technical Bulletins TB5-890-1 and -2, Ordnance and Explosive Risk Assessment, August 1993, U.S. Army.
- Anti-Aircraft Artillery Site Proposed Characterization Methodologies, Hanford Site North Slope ERA, September 1992, by IT Corporation
- Standing Operational Procedures for Performing Preliminary Assessments at Potential Ordnance and Explosive Waste Sites, July 1992, COE.
- Explosive Ordnance Recognition and Safety Class, 1993, COE.

Mr. Heaton introduced Mr. Stillings and Ms. Neketuk to Mr. Jeff Neece, Safety Specialist (former EOD), to identify technical information regarding the munitions found at Hanford. Mr. Neece was unable to provide any information because the documents he was aware of were classified.

December 14, 1993

Battelle/Pacific Northwest Laboratory, Richland, Washington

Battelle/Pacific Northwest Laboratory is a national laboratory and the research and development center for Hanford. Mr. Stillings and Ms. Casper interviewed Mr. Lee Rogers, ALE Reserve Manager. Evidence of small arms and training mines with smoke charges was found during research conducted by Battelle. This was found mostly in the flat-lying areas below an elevation of 1,200 feet. Mr. Rogers recommended that we speak with Mr. Charlie Brandt, Biologist for the Riverlands Area. Mr. Brandt found fox holes and small-arms brass located in the Riverland Area.

During interviews with several other individuals, it was recommended that Dames & Moore discuss the findings made by Battelle/Pacific Northwest Laboratory archaeologists. Ms. Mona Wright, Archeologist, Mr. George Last, Geologist and Manager of Cultural Resources were interviewed. In their site visits, they found evidence of ordnance located south of the Columbia River. These and other ordnance findings were given to Mr. Roos at Westinghouse and reported in the North Slope Expedited Response Action Proposal, 1993. Findings at the Arid Lands

Ecology Reserve included small arms ammunition and artillery crates, all of which were reported and recovered for appropriate disposition.

Also provided by Ms. Wright was access to a collection of aerial photographs maintained by the Battelle Cultural Resources Division. The four representatives of Dames & Moore reviewed photographs covering the Hanford Site for the years 1941, 1948, 1964, 1968, 1972 and 1981. Locations of significant agricultural development, remains of former antiaircraft batteries and NIKE launch and control sites were noted. Some evidence of impact craters were observed on the Arid Lands Ecology Area in the 1972 photograph. No impact areas or evidence of ordnance was observed in other areas. The scale of the photographs (typically 1:20,000) made details difficult to discern.

Public Meeting, North Slope Expedited Response Action, Mattawa Elementary School, Mattawa, Washington

Mr. Stillings, Ms. Neketuk, Ms. Kristine Casper, and Mr. Dan Viegut of Dames & Moore attended a public meeting as requested by Mr. Walter Perro of the COE, Richland, Washington office, and Mr. Charles Heaton of the Huntsville, Alabama office. Mr. Heaton, also attended the meeting. The focus of the meeting was to discuss the plans to cleanup the North Slope. A summary of the military history was presented by Mr. Perro, and outlined the potential environmental, and physical hazards including possible ordnance-related contamination. The public was informed that an ordnance specialist was at the meeting and if anyone had knowledge of ordnance at the North Slope to meet Dames & Moore or to contact Mr. Perro. There were no responses received. A commissioner representing each of the four counties (Adams, Benton, Franklin and Grant) spoke at the meeting to discuss their interest in returning the North Slope for unrestricted uses, including agriculture. Several people who spoke at the meeting were later contacted by Dames & Moore for interviews (see Appendix B for interview notes).

December 15, 1993

Mid-Columbia Library, Richland Branch, Van Giesen Way, Richland, Washington

Mr. Viegut and Ms. Neketuk of Dames & Moore visited the Richland Branch Library to review the indexes for books, articles or relevant military history on Hanford. No significant information pertinent to this study was found.

Hanford Field Trip of the North Slope and Riverland Study Areas

Mr. Stillings, Ms. Casper, Mr. Charles Heaton, and Mr. Walter Perro attended a field trip of the North Slope. The field trip was arranged by Mr. Perro, and conducted by Mr. Richard Roos, Manager, Site Remediation Section, of Westinghouse Hanford Company. Mr. Roos has been the leader in conducting extensive research at the North Slope for the past several years. Along the bluffs east of the Columbia River in the southwest corner of Franklin County, evidence of .50- and .30-caliber slugs, 37 mm containers were identified.

In another area east of the Columbia River, identified as having been occupied by the A Battery of the 519th AAA Gun Battalion, evidence of a waste disposal site (identified as a gravel pit in other records) and an AAA gun site were identified. The evidence of the gun site consisted of C-ration and 120mm container debris.

West of the 519th A Battery site, was an area at which Mr. Roos had identified shrapnel during previous investigations. The area consisted of sand dunes with stabilized vegetation. No impact craters were noted. No shrapnel was found during this field trip. The "Shrapnel Area" is identified in Figure 4 of the North Slope Expedited Response Action Proposal.

Ms. Neketuk and Mr. Viegut also attended a field trip of the Riverland Area, arranged by Mr. Perro, conducted by Mr. Paul Valcich, Engineer of the Area Remediation Section at Westinghouse Hanford Company. Mr. Valcich has been assigned to the Riverland Area for about 1½-years, is familiar with the history of military activities and completed a report identifying the locations of waste sites found in his work. The major waste sites have been cleaned up under the direction of Mr. Valcich. Evidence of military waste, homesteads prior to the military occupation and other activities are reported in Riverland Expedited Response Action Proposal, April 1993. Debris from several empty 105mm containers were found in the southeast portion of the site during the field visit. No evidence of unexploded ordnance was observed. Ordnance found at the Riverland Area in the past included a munitions cache site in the southeast corner, near Highways 240 and 24. A .50 caliber round belt was found and turned into the Hanford Patrol Office. Various military explosives were stored in the munitions cache in the 1970s. These remnants were left in a wooden box that was buried in a 2 by 3 by 2 foot deep area. According to Mr. Valcich, the entire box, with its contents was sent to the Yakima Firing Range to be destructed.

December 16, 1993

Westinghouse Hanford Company, Environmental Resource Center, 740 Building, Richland, Washington

As recommended by Mr. Walter Perro and others interviewed during this investigation, Michelle Gerber, PhD., Historian was interviewed by Mr. Stillings and Ms. Casper for military history information. Dr. Gerber provided a list of antiaircraft battalions at Hanford, as well as numerous historical articles and documents regarding site activities, daily operations and personnel at Hanford. Dr. Gerber has written a book, On The Home Front, that provided significant information on the activities at Hanford.

December 17, 1993

Battelle/Pacific Northwest Laboratory, Richland, Washington

As recommended by Ms. Wright and Mr Last at Battelle, Ms. Casper and Mr. Stillings met with Ms. Natalie Cadoret, Geologist to discuss findings she had encountered during field visits.

Ms. Cadoret was also had findings of ordnance at the Arid Lands Ecology Area where an ammunition box was found in the west slope of Cold Creek Valley. This material was reported and removed. No distinct burial areas were observed.

January 4-5, 1994

U.S. National Archives and Records Administration, Washington D.C.

Mr. Stillings and Ms. Neketuk of Dames & Moore visited the NARA is the central repository location for many military records. Prior to visiting Washington D.C., Dames & Moore submitted a letter requesting pertinent information relevant to ordnance research, as recommended by Ms. Karren at the Seattle, Washington National Archives Branch. Mr. Edward Reese provided the record numbers that would be of most interest to this study. Mr. Stillings and Ms. Neketuk reviewed the records which consisted of administrative actions, intelligence and security information regarding the U.S. Army's role in the development and production of nuclear weapons.

After the nuclear bombs were used on Japan, the records indicated that the Atomic Energy Commission assumed control of the nations' nuclear production plants on January 2, 1947.

Specific data relative to military records and ordnance issues was not identified.

January 4-6, 1994

U.S. National Archives and Records Administration Suitland Reference Branch, Washington D.C.

In trip reports completed by Mr. Dennis DeFord, historian at Westinghouse, U.S. Army records are also held at the NARA in Suitland. A fifteen minute shuttle bus ride from the main NARA branch in downtown D.C to the NARA in Suitland was available and used frequently by Dames & Moore.

Mr. Stillings and Ms. Neketuk met Mr. Richard Boylan, Assistant Branch Chief with NARA, Suitland. He assigned Ms. Rebecca Lentz Collier, Reference Archivist who was very knowledgeable in identifying military records that were pertinent to Hanford. Records from 1950 to 1953 of the 5th Group, Battalion 501st, 518th, 519th, 83rd and 770th were reviewed. The records consisted of Command Reports of each battalion, illustrations of the battery positions, summary of the tri-annual service practices held at Yakima Firing Range where nearly all of the firing practices were held, and daily journal notes summarizing significant events of that day.

January 11, 1994

U.S. Army Military History Institute, Carlisle Barracks, Pennsylvania

Mr. Stillings and Ms. Casper visited the U.S. Army Military History Institute at Carlisle Barracks. Based on research conducted by Dr. Michelle Gerber and Mr. Dennis DeFord, Westinghouse historians and Ms. Susan Karren, Seattle National Archivist, this repository was recommended because of the extensive inventory of general military records held there. Mr. Dennis Vetock, historian at Carlisle Barracks was contacted and identified specific records pertaining to our research. A document entitled, Antiaircraft Artillery Battalions of the U.S. Army, 1991, by J. A. Sawicki proved useful in identifying when the specific groups were deactivated from Hanford defense posts. A U.S. Army Air Defense Command newspaper provided an article documenting that the last of the AAA guns were decommissioned and replaced by NIKE missiles in 1957.

January 12, 1994

U.S. National Archives and Records Administration, Atlanta, Georgia

Mr. Reese of the NARA, Washington D.C. recommended Dames & Moore contact Mr. Charles Reeves, a Manhattan Engineer District (MED) specialist in Atlanta, Georgia. Mr. Reeves indicated that he had numerous records for the MED and Hanford that may be useful to this records review. Mr. Stillings and Ms. Casper reviewed the information held at this repository. Although numerous documents were available, no information regarding ordnance or related Hanford operations was discovered.

April 11-13, 1994

U.S. Army Air Defense Center, Fort Bliss, Texas

Ms. Neketuk contacted the U.S. Army Air Defense Artillery (ADA) center in Fort Bliss, Texas to determine if military historical records of the Nike or AAA battalions assigned to Hanford were located at any of their repositories. Mr. Peterson of the ADA School Library, Ms. Mary Jean Murray, Sergeant Major Academy, Ms. Teri Cornell, Archivist for the ADA Museum, Mr. Case from the ADA Magazine, and Ms. Pews of the ADA Central Library were contacted. The information available was limited to general historical data for various U.S. installations. No specific information was available pertaining to military installations on assignment at Hanford. It was recommended that a review of the books, Air Defense Artillery, and AAA Battalions of the U.S. Army, may provide a source of information. These references were consulted and some limited information was provided.

INTERVIEWS

Telephone interviews were made by Dames & Moore personnel. The findings made and persons interviewed are summarized below.

November 17, 1993

Gilk, Lyle, DOE Security Officer

Mr. Gilk was contacted by Mr. Stillings as recommended by Jerry Yesberger, former DOE Security Officer. According to Mr. Gilk, EOD personnel conducted a search of the North Slope, Arid Lands Ecology Reserve and the Yakima Firing Range 4 or 5 years ago, due to complaints made by an ex-employee who claimed that pieces of shrapnel were found. The results of the investigation indicated that very little was found at the North Slope battery locations, and nothing was found at the Arid Lands Ecology Area. Munitions were located in the North Slope and White Bluffs area consisting of 40mm, 81mm, 75mm, 120mm and 175mm rounds.

November 22, 1993

Edwards, Lieutenant Colonel, of the Yakima Training Center Headquarters

Mr. Stillings contacted provided names and phone numbers of 53rd Ordnance Detachment, Explosive Ordnance personnel, Sergeant Hathaway and Sergeant Wallace for possible on site personal accounts of the Hanford activities.

Hathaway, Sergeant, Explosive Ordnance officer, 53rd Ordnance Detachment

Mr. Stillings contacted and referred Dames & Moore to Sergeant Wallace who had been at Hanford for a short period of time.

Wallace, Sergeant, Explosive Ordnance officer, 53rd Ordnance Detachment

Mr. Stillings contacted who indicated that he was at the North Slope about one year ago and found 155 mm, fired, unexploded artillery rounds. He could not recall how many he found. Sergeant Wallace indicated that he also found several sub-munition (bomblets) of Japanese origin in the area.

November 30, 1993

Stedman, Gary, Supervisor, Environmental Resources Branch, Fort Lewis

Mr. Stillings contacted Mr. Stedman at the suggestion of Mr. Craig Haggy, Director of the Fort Lewis museum. Although Mr. Stedman was aware of the AAA sites at Hanford, he had no first-hand knowledge of the sites and no Camp Hanford records were available from Fort Lewis.

December 7, 1993

Fancher, Helen, Grant County Commissioner

Mr. Stillings contacted Ms. Fancher. Ms. Fancher provided two residents of the area who may have personal knowledge of the area. She did not have any personal knowledge of ordnance uses but provided additional contacts (Mr. Mark Hedman, Mr. Jim Eklund, and Mr. Ekenberg) with local personnel involved in the citizen's action group that developed the Wahluke 2000 Plan.

Hoffman, Jim, Former Yakima Firing Range Officer

Mr. Stillings contacted Mr. Hoffman who indicated that the only activity in the North Slope Area was for bivouac. No firing of any kind was conducted. According to Mr. Hoffman, The Yakima Firing Center was used for artillery practice.

Shay, Mike, Grant County Sheriff

Mr. Stillings contacted Mike Shay to determine if there have been any incidents of ordnance found and reported to his office. According to Sheriff Shay, in the past 14 years that he has been at Grant County, he is not aware of any unexploded ordnance issues reported to them. He also contacted Sergeant Moorland, retired, who during the 1950s handled these types of reports. Sgt. Moorland had no information regarding ordnance in the Hanford area.

Weller, John, Fort Lewis Range Control Officer

Mr. Stillings contacted Mr. Weller who indicated that there has been no Army firing in Hanford since 1981. Mr. Weller referred Dames & Moore to Mr. Jim Hoffman, Former Range Control Officer at Yakima.

December 13, 1993

Cyr, Lorin Major-USA, Manager of the Patrol Operations Center, Hanford Patrol

Mr. Viegut contacted Major Cyr. Major Cyr indicated that he recalled the location of a few artillery sites and an old impact area on the northeast side of Gable Mountain, where they found a high explosive round. The 47th EOD from Yakima disposed of it. Several areas of artillery found at Hanford were marked on a map and reviewed by Dames & Moore. Major Cyr also referred Dames & Moore to Dick Melbihess of Westinghouse.

Ekenberg, Ed, U.S. Army Camp Hanford, retiree

Ms. Casper contacted Mr. Ekenberg. Mr. Ekenberg was stationed on the North Slope area in the late 1950s. He arrived in late 1956 during AAA gun decommissioning. Mr. Ekenberg had no knowledge of ordnance waste on the North Slope and was surprised that ordnance was of concern due to the minimal firing and extensive cleanup conducted by the U.S. Army in the late 1950s. Mr. Ekenberg also indicated that the waste materials disposed in the battery and headquarters dumps consisted primarily of mess-hall and office trash and that, to his knowledge, no ordnance was disposed in the dumps.

Eklund, Jim, currently a local farmer

Mr. Viegut contacted Mr. Ekland formerly with Battelle in Hanford. Mr. Eklund was not aware of any ordnance findings other than those already identified by the COE.

Goswami, Dib, Project Unit Manager and Hydrogeologist for the Washington Department of Ecology, Hanford Project Office in Kennewick, Washington

Ms. Neketuk contacted Mr. Goswami for information as recommended by Mr. Walter Perro with the COE. The purpose of the call was to evaluate any information or interview pertinent individuals known to the state that should be included in this study. No specific information was made available, and Mr. Goswami indicated that he had no knowledge of unexploded ordnance at Hanford.

Hedman, Mark, a local farmer

Ms. Casper contacted Mr. Headman and resident of the area. Mr. Hedman did not have knowledge of ordnance findings or military activities at Hanford other than those already reported in COE reports.

Houchin, Bill, City of Richland Fire Inspector

Mr. Viegut contacted Mr. Houchin to find out about whether they have received calls or had to respond to ordnance and explosive waste. Inspector Houchin has been with the fire department for 25 years, and the records on file dating back to 1958. Based on his recollection and review of records, he does not believe they have ever been involved in this type of lead or activity at Hanford.

Pasternak, Charles DOE Landlord Program Manager

Mr. Viegut contacted Mr. Pasternak, as recommended by Mr. Yesberger. Mr. Pasternak had no knowledge of ordnance at Hanford.

Westinghouse Fire Chief's Office

Mr. Viegut contacted the Westinghouse Fire Chief's Office for leads to possible ordnance issues handled. It was recommended that we speak with the Manager at the Patrol Operations Center.

December 14, 1993

Compton, Spencer, a retired ICF Kaiser Engineers Surveyor and Hanford Patrol Officer at Hanford

Ms. Neketuk contacted Mr. Spencer, as recommended by Vern Coyne of ICF Kaiser Engineers. Mr. Compton worked for ICF Kaiser and other contractors as a surveyor at Hanford for 41 years. The first battery sites were surveyed when the AEC provided Mr. Compton's office with specific sections where they wanted them located. Related to munition findings, several unused boxes of 20 mm bullets were found between Benson and Snively Ranches on the ALE Reserve. The boxes were given to the Hanford Patrol. Spent casings of 45 mm shells were found on several sites on the North Slope. One main location was about 5 to 6 miles northeast of the Vernita Bridge.

Melbihess, Dick, Principle Engineer of Fire Protection at Westinghouse

Mr. Dan Viegut contacted Mr. Melbihess who indicated that he was also aware of the Gable Mountain area that was used as a pistol range, and other ordnance found. Mr. Melbihess indicated that much field work has been conducted and Dames & Moore should contact Mr. Richard Roos of Westinghouse.

December 30, 1993

Warby, Dan, former Military Police, 62nd detachment

Mr. Stillings contacted Mr. Warby as recommended by Ms. Annette Heriford. Mr. Warby's family has worked in the Hanford area since Camp Hanford was activated. Mr. Warby joined the U.S. Army and was assigned to Camp Hanford from 1951 to 1955 as a military police and special agent. Mr. Warby recalled the 120mm AAA battalions and NIKE missiles but was unable to provide information regarding potential locations of ordnance.

January 18, 1994

McHale, J., a resident of Richland, Washington, and a retired AEC Security Officer

Ms. Neketuk contacted Mr. McHale who was Chief of Inspection branch during U.S. Army occupation in 1943 to 1948, Deputy of Security, 1948 to 1952, and Director of Security from 1952 to 1972. Mr. McHale indicated that there was no on-site disposal of any materials at Hanford. Mr. McHale also indicated that settling rounds were conducted on the 120 mm anti

aircraft guns. The guns were only fired once, and no duds were reported during the one firing routine.

Turner, Eugene, former U.S. Army Soldier and Hanford Patrol Officer

Ms. Neketuk contacted Mr. Turner who was listed in Mr. DeFord's records as a possible source of information. Mr. Turner was enlisted with the 501st battalion, C Battery at Hanford and was stationed there from the spring of 1950 to September 1952. Mr. Turner stated that the 120mm guns were fired once, and obtaining security clearance to fire the guns was difficult. The Hanford Patrol was at the battery while the firing took place. Four settling rounds were released per gun. No calibration rounds were fired, because the firing was synchronized with the radar command post. According to Mr. Turner, each battery had four 120mm AAA guns, and 16 .50-caliber machine guns (four at each 120mm AAA gun), and one 3.5-inch antitank rocket launcher. Five men were assigned to each 120mm gun, and two or three men were assigned to each machine gun. Mr. Turner also indicated that each soldier (about 120 at his battery) was required to carry 30 rounds of ammunition with his carbine .30-caliber rifle everywhere they went, including the mess hall. Ammunition was stored in an "ammo dump" located close to where Highway 240 is today. The munitions were stored underground and each bullet was accounted for. All solid waste was collected and picked up on a regular basis, and nothing was dumped at the camp. Nine days on and three days off was the typical work schedule for the enlisted men. During the three days off they rested at the Richland Barracks. After serving his term with the U.S. Army, Mr. Turner was in charge of Hanford security for 30 years until he retired in 1982.

August 16, 1994

Eaton, Jim, Research Assistant, Tri-Services Cultural Resources Research Center, Champaign, Illinois

Ms. Neketuk contacted Mr. Eaton for information he has collected concerning Nike missile sites associated with the Hanford defense area. Mr. Eaton also provided details of missile storage and launcher designations.

APPENDIX C
Trajectory Calculations

A summary of various factors used to determine likely shooting ranges of the 120mm gun batteries is presented in Section 5.5, Field of Fire at Hanford. In order to calculate the most-likely horizontal and vertical ranges of the guns fired at Camp Hanford, several factors were inserted to solve relatively complex differential equations. The details of the equations are described below.

The potential trajectories and ranges of 120mm projectiles were calculated by solving the following differential equation:

$$m\frac{d^2\vec{r}}{dt^2} = -mg\hat{z} - e^{-z/h}\left(bv\vec{V} + A_b P_0\left(1-\frac{P_b}{P_0}\right)\frac{\vec{V}}{V}\right)$$

where:
m = *mass of projectile*
$\vec{r}$ = *position vector of projectile*
g = *acceleration of gravity*
$\hat{z}$ = *unit vector, z direction*
b = *drag constant*
h = *height at which the density of air equals 1/e its value at sea*
$\vec{v}$ = *velocity of projectile*
t = *time (seconds)*

(1)

The first term on the right hand side of equation (1) takes into account the force on the projectile due to gravity. The second term on the right hand side of equation (1) models both the turbulent air resistance that the projectile encounters as well as the change in air density as a function of the height of the projectile. If the motion of the projectile is assumed to be in the x-z plane, then equation (1) is equivalent to the following two coupled differential equations:

$$\begin{aligned} m\frac{d^2x}{dt^2} &= -e^{-z/h}\left(bv + A_b P_o\left(1-\frac{P_b}{P_o}\right)v^{-1}\right)\frac{dx}{dt}, \\ m\frac{d^2z}{dt^2} &= -mg - e^{-z/h}\left(bv + A_b P_o\left(1-\frac{P_b}{P_o}\right)v^{-1}\right)\frac{dz}{dt} \end{aligned} \qquad \textbf{(2)}$$

The initial conditions assumed when solving these equations were:

The differential equations (2) were solved numerically using the program *Mathematica* (© 1991 by Wolfram Research, Inc.).

$$x_0 = z_0 = 0,$$
$$v_{x0} = v_0 \cos\theta,$$
$$v_{z0} = v_0 \sin\theta, \quad (3)$$

where:
v_0 = *muzzle velocity*
θ = *gun elevation* ($\angle$).

APPENDIX D
Miscellaneous Information
(Correspondence referred to on page 6, paragraph 4)

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UNITED STATES
ATOMIC ENERGY COMMISSION
RICHLAND OPERATIONS OFFICE
P. O. BOX 550
RICHLAND, WASHINGTON 99352

IN REPLY REFER TO:

AP:HOS

September 4, 1964

U. S. Army Engineer District Seattle
Corps of Engineers
1519 Alaskan Way South
Seattle, Washington 98134

Attention: District Engineer

Reference: NPSRE-MD Camp Hanford
Washington, Inv. #62-4

Gentlemen:

Relating to Army-AEC Memorandum of Agreement DA 45-164-eng-1187 with supplements as of August 12, 1964, this office of the Atomic Energy Commission accepts the transfer of the land comprising the site of Camp Hanford as being fully restored to our satisfaction, thereby terminating and releasing you from this portion of the above land use agreement.

This action leaves only the telephone repeater station on Rattlesnake Mountain (Bldg. #T-52C-6) under a separate permit and is excluded from above referenced M/A DA 45-164-eng-1187.

Very truly yours,

N. G. Fuller, Director
Property Division

See S/A No. 5, Paragraph 9
Retransfer Letter In L + Use Permits

UNITED STATES
ATOMIC ENERGY COMMISSION
HANFORD OPERATIONS OFFICE
P. O. BOX 550
RICHLAND, WASHINGTON

IN REPLY REFER TO: MA:NGF

July 6, 1962

Seattle District Engineer
Corps of Engineers
1519 South Alaskan Way
Seattle 4, Washington

Subject: CAMP HANFORD, WASHINGTON--USE PERMITS TO ARMY

Attention: Real Estate Division

Dear Sir:

Your letter of June 25, 1962, referred to the various land use permits issued by the Atomic Energy Commission to the Army during the period the Army occupied Camp Hanford and its related forward areas.

With the exception of agreements relating to the site of Camp Hanford and to the telephone repeater station on Rattlesnake Mountain (Building No. T-52C-6), all land use permits and agreements for temporary use of AEC lands, related to the Army's operation on the Hanford reservation, have been terminated. The lands involved in these terminated permits and agreements have been returned to the sole jurisdiction of the AEC in a condition satisfactory to the Commission.

Very truly yours,

Norman G. Fuller

Norman G. Fuller
Real Estate Officer

Retransfer
Disposal [illegible] Use Permits

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208-2870

REPLY TO
ATTENTION OF

CENPD-EN-TE (200-1a)

8/8/90

MEMORANDUM FOR

Commander, Seattle District, ATTN: CENPS-EN

Commander, U.S. Army Corps of Engineers, Huntsville Division,
ATTN: CEHND-ED-PM, P.O. Box 1600, Huntsville, AL 35807-4301

SUBJECT: Defense Environmental Restoration Program for Formerly-Used Defense Sites (DERP-FUDS); Inventory Project Report (INPR), for Site F10WA026000, Camp Hanford, Richland, Washington

1. This memorandum approves the No Further Action (NOFA) recommendation.

2. I request that:

a. CENPS-EN, within 60 days of the date of this memorandum, notify the landowner(s) of the decision and provide copies of the notification letter(s) to CEMP-RF, CEHND-ED-PM, and this office.

b. CEHND file this INPR and update the inventory database.

3. CENPD-EN-TE POC for this matter is Mr. Moon-Yong Han, com (503) 326-7361.

Encl

PAT M. STEVENS IV
Brigadier General, USA
Commanding

CF w/encl:
CEMP-RF

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX C-3755
SEATTLE, WASHINGTON 98124-2255

REPLY TO ATTENTION OF

JUN 21 1990

CENPS-EN-GT-HW (200-1a)

MEMORANDUM FOR Commander, North Pacific Division
ATTN: CENPD-EN-TE

SUBJECT: Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS) Inventory Project Report (INPR) for Site No. F10WA026000, Camp Hanford

1. This INPR reports on the DERP-FUDS preliminary assessment (PA) of Camp Hanford. Several site visits were made by Seattle District personnel between 1986 and 1990, most recently during the week of 6 April 1990. The site survey summary sheet and a site map are at Encl 1.

2. We determined that the site was formerly used by the Army. A recommended Findings and Determination of Eligibility (FDE) is at Encl 2.

3. We also determined that there is no hazardous waste at the site eligible for cleanup under DERP-FUDS, and that no further action is required.

4. I recommend that you:

a. Approve and sign the FDE;

b. Forward a copy of the INPR to CEHND for the PA file.

Milton Hunter

2 Encls
as

MILTON HUNTER
Colonel, Corps of Engineers
Commanding

SITE SURVEY SUMMARY SHEET
DEFENSE ENVIRONMENTAL RESTORATION PROGRAM
FOR FORMERLY USED DEFENSE SITES (DERP-FUDS)
SITE NO. F10WA026000
CAMP HANFORD, WASHINGTON
June 1990

SITE NAME: Camp Hanford

LOCATION: Richland, Washington (see attached map)

SITE HISTORY: Camp Hanford was acquired by the Department of Defense (DOD), primarily by permits from the Atomic Energy Commission (AEC), for the Army, Air Defense Command, in 1950-1956, and disposed of between 1959 and 1964. A total of 3,680.58 acres were acquired. The purpose of Camp Hanford was to provide air defenses for the Hanford Atomic Energy Reservation and vicinity, an area of over 500 square miles. Seventeen antiaircraft positions, four Nike batteries, two ammunition storage facilities, a firing range, cantonment area, roads, wells, and services (water, electrical and sewage) were constructed, improved, or installed. As portions of Camp Hanford were relinquished to the AEC, some improvements were removed while others were transferred to the AEC in lieu of restoration. The AEC and its successor, the Department of Energy (DOE), have reused, removed, or demolished most of the Camp Hanford structures/developments. An extensive cleanup program was carried out during the mid-1970's by the AEC which included many former military use areas.

The portion of the reservation north and east of the Columbia River which formerly held seven antiaircraft positions, three Nike batteries (H-06, H-12, and H-83), and a munitions storage site, all now demolished and cleared, is administered by the U.S. Fish and Wildlife Service (west half) and Washington Department of Wildlife (east half). Nike site H-52 was retained intact and is currently used as a research facility and bomb shelter. The firing range has been expanded and modernized, and is used by the Hanford Patrol, the Hanford security force. The cantonment area, 974.00 acres just north of Richland, was acquired by the city, and then by the Port of Benton County for redevelopment as a business and industrial park.

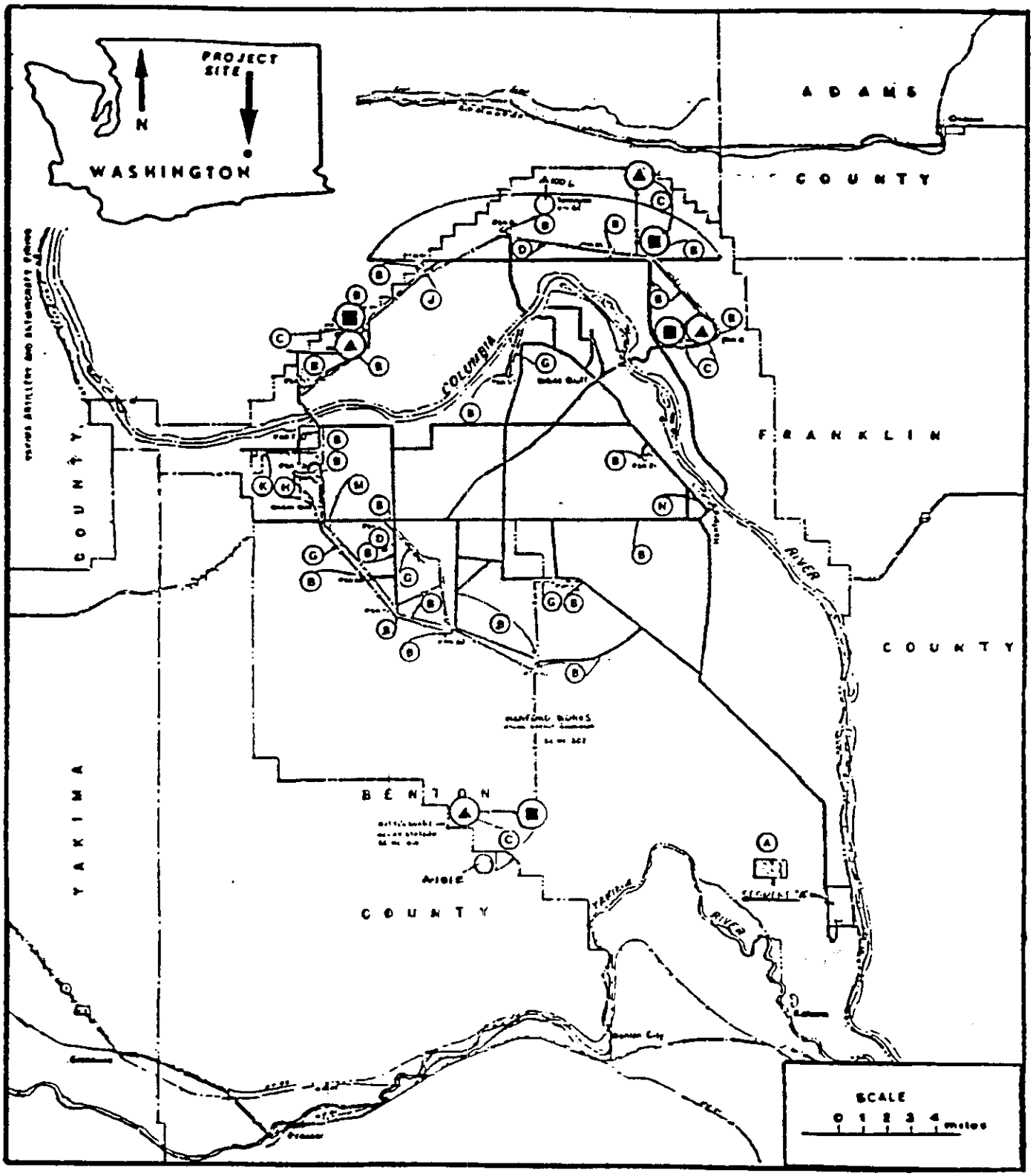
SITE VISIT: Several site visits were made by Seattle District personnel (Jonathan A. Maas, CENPS-EN-GT-HW and Dr. David G. Rice, CENPS-EN-PL-ERS) between 1986 and 1990. DOE, Westinghouse, Battelle, other contract personnel, and area residents were interviewed and/or participated in field searches. Extensive notes on observations, documents, informant recollections, taped interviews, and site photographs are in the project file at Seattle District.

CATEGORY OF HAZARD: No DOD-caused hazards associated with the former Camp Hanford were identified.

PROJECT DESCRIPTION: No project is proposed.

AVAILABLE STUDIES AND REPORTS: Various books and articles on the Hanford Reservation make references to former Camp Hanford.

POC/DISTRICT: Jonathan A. Maas, CENPS-EN-GT-HW, (206) 764-6745



CAMP HANFORD - F10WA026000

Attachment

Figure shows a representation of the Hanford Works as it appeared in the 1950's. Notation: ▲ NIKE control areas; ■ NIKE launching areas; and letters denote tract numbers referred to in text. Inset show the site in relation to a State map.

DEFENSE ENVIRONMENTAL RESTORATION PROGRAM
FOR FORMERLY USED DEFENSE SITES
FINDINGS AND DETERMINATION OF ELIGIBILITY

Camp Hanford, Washington

Site No. F10WA026000

FINDINGS OF FACT

1. Camp Hanford is located approximately 2 miles north of Richland, in portions of Benton, Franklin, and Grant Counties, Washington. It was acquired for the Department of the Army, Air Defense Command, in 1950-1956. A total of 3,680.58 acres in 12 tracts were acquired as follows:

a. Tract "A". 611.14 acres public domain acquired in 1953 by use permit from the Atomic Energy Commission (AEC) for a small arms and machine gun range;

b. Tract "B". 1,700.00 acres use permits acquired in 1950 by transfer from the AEC for camps and roads (340.00 acres exclusive use for seventeen dispersed antiaircraft positions of 20 acres each and 1,360.00 acres as jointly used roads;

c. Tract "C". 219.70 acres use permits acquired in 1953 by transfer from the AEC for the construction of launch and control areas for four Nike batteries (H-06, H-12, H-52, and H-83);

d. Tract "D". 168.73 acres use permits acquired in 1954 by transfer from the AEC for ammunition storage igloos and a safety zone;

e. Tract "G". One no-area use permit acquired in 1952 by transfer from the AEC for a water supply line;

f. Tract "H". One no-area use permit acquired in 1952 by transfer from the AEC for a water pipe connection at McGee Well.

g. Tract "J". One no-area use permit acquired in 1952 by transfer from the AEC for electrical distribution system use;

h. Tract "K". One no-area use permit acquired in 1952 by transfer from the Bonneville Power Administration (BPA) for electrical distribution system use;

i. Tract "L". 974.00 acres use permits acquired in 1951 by transfer from the AEC for North Richland cantonment area use;

j. Tract "N". 0.01 acre use permit acquired in 1955 by transfer from the AEC for ferry landing, building, water system, and access road use;

k. Tract A100L. One no-area, no-cost license acquired in 1953 from Grant County for road construction and improvement over a portion of an existing county road;

l. Tract A101E. 7.00 acres easement acquired by purchase in 1955 from Virgil O. McWhorter, et al., perpetual right to construct and operate a road;

2. The purpose of Camp Hanford was to provide air defenses for the Hanford Atomic Energy Reservation and vicinity, an area of over 500 square miles. Seventeen antiaircraft positions, four Nike batteries, two ammunition storage facilities, a firing range, cantonment area, roads, wells, and services (water, electrical and sewage) were constructed or installed.

3. The Camp Hanford property was disposed of between 1959 and 1964 as follows:

a. Tract "A". All 611.14 acres were returned to the custody of the AEC effective 12 August 1964 and are still under the control of the Department of Energy (DOE).

b. Tract "B". Twenty acres were returned to the custody of the AEC effective 5 May 1959, and the remaining 1,680.00 acres were returned effective 21 December 1960. All 1,700.00 acres are still under the control of the DOE.

c. Tract "C". All 219.70 acres were returned to the custody of the AEC effective 12 August 1964 and are still under the control of the DOE.

d. Tract "D". All 168.73 acres were returned to the AEC effective 12 August 1964 and are still under the control of the DOE.

e. Tract "G". The no-area use permit rights were returned to the AEC effective 29 November 1960.

f. Tract "H". The no-area use permit rights were returned to the AEC effective 29 November 1960.

g. Tract "J". The no-area use permit rights were returned to the AEC effective 12 August 1964.

h. Tract "K". The no-area use permit rights were returned to the BPA effective 30 October 1961.

i. Tract "L". All 974.00 acres were returned to the custody and control of the AEC effective 12 August 1964. The property was then acquired by the city of Richland, and subsequently conveyed to the Port of Benton County.

j. Tract "N". The 0.01 acre use permit rights were returned to the AEC effective 28 November 1960 and are still under the custody and control of the DOE.

k. Tract A100L. The no-area license was terminated effective 1 November 1961. The United States was relieved of any liability by a release signed by the Grant County Board of County Commissioners on 6 November 1961.

l. Tract A101E. The acquisition deed contains a statement that the consideration originally paid is accepted as full compensation for all damages incidental to the exercise of the rights and privileges granted. Custody of the 7.00 acres easement was transferred to the AEC on 1 November 1961, and is still under the control of the DOE.

DETERMINATION

Based on the foregoing findings of fact, the site has been determined to be formerly used by the Department of Defense. It is therefore eligible for the Defense Environmental Restoration Program - Formerly Used Defense Sites, established under 10 USC 2701 et seq.

8/8/90
DATE

PAT M. STEVENS IV
Brigadier General, USA
Commanding

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